SOCIETY OF AMERICAN FORESTERS 1900

Journal of FORESTRY

January 1960
Volume 58
Number 1

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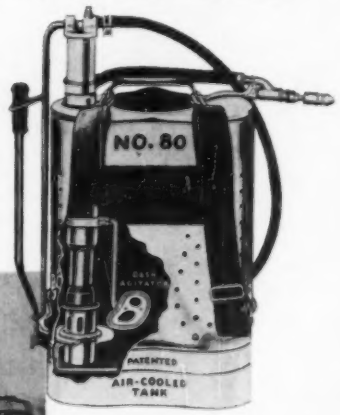

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Photo by Winston Steuernald, U. S. Forest Service

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FUNDAMENTALS OF FORESTRY ECONOMICS By William A. Duerr, State University of New York College of Forestry, Syracuse University. The American Forestry Series. Ready in January.

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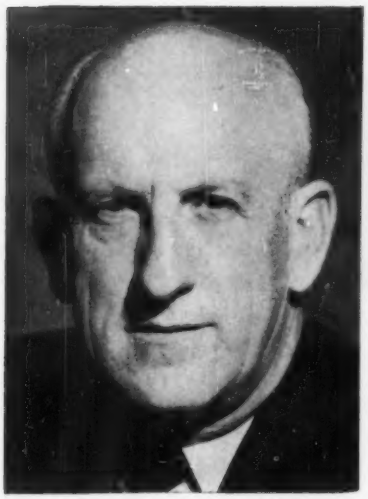
Society of American Foresters Elects New Officers and Fellows



CHARLES A. CONNAUGHTON

CHARLES A. CONNAUGHTON, regional forester of the California region of the U. S. Forest Service, with headquarters at San Francisco, has been elected president of the Society of American Foresters for the two-year term 1960-1961. He succeeds George A. Garratt of Yale University, New Haven, Conn., who was not a candidate for re-election as president.

Mr. Connaughton obtained his education at the University of Idaho College of Forestry and at Yale University School of Forestry. He has been with the U. S. Forest Service for thirty years, and has been director of the Rocky Mountain Forest and Range Experiment Station at Fort Collins, Colo.; director of the Southern Forest Experiment Station at New Orleans; regional forester of the Southern Region of the Forest Service at Atlanta, Ga.; and since 1955 he has been regional forester at San Francisco.

Henry J. Malsberger of Atlanta, Ga., has been re-elected as vice president. He is a forestry graduate of the Pennsylvania State University. His career began in Florida where he rose to the position of state forester and park executive. Since 1945 he has been with the Southern Pulpwood Conservation Association, an industry sponsored organization of which he is general manager.

Council Members Elected

Organized in 1900 with headquarters in Washington, D. C., the Society of American Foresters has 13,000 members in the United States and Canada. Its governing body is the Council, composed of the president, vice president, and nine additional members. The following foresters were elected to the Council for the two-year term 1960-1961:

B. E. Allen, manager of the Woodlands Division, Union Bag-Camp Paper Corporation, Savannah, Ga.

William C. Bramble, head of the Department of Forestry and Conservation, Purdue University, Lafayette, Ind.

Donald E. Clark, regional forester of the Rocky Mountain Region, U. S. Forest Service, Denver, Colo.

Kenneth P. Davis, chairman of the Department of Forestry, School of Natural Resources, University of Michigan, Ann Arbor, Mich.

George A. Garratt, dean of the School of Forestry, Yale University, New Haven, Conn.

William D. Hagenstein, executive vice president, Industrial Forestry Association, Portland, Ore.

Svend O. Heiberg, professor of silviculture, State University of New York, College of Forestry, Syracuse, N. Y.

HENRY J. MALSBERGER

Richard J. Preston, Jr., dean of the School of Forestry, North Carolina State College, Raleigh, N. C.

Charles L. Tebbe, regional forester, Northern Rocky Mountain Region, U. S. Forest Service, Missoula, Mont.

Fellows Elected

In addition to the foregoing officers, the following 13 foresters were elected to the grade of Fellow. Election to this grade is conferred only for outstanding service to forestry.

John H. Allison, professor emeritus, School of Forestry, University of Minnesota, St. Paul, Minn.

Charles A. Connaughton, regional forester, U. S. Forest Service, San Francisco, Calif.

John W. Duffield, technical director, Col. W. B. Greeley Forest Nursery, Industrial Forestry Association, Nisqually, Wash.

Paul M. Dunn, director of for-

Elected to SAF Council for 1960-1961

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Francis H. Eyre, U. S. Forest Service retired; editorial staff, Society of American Foresters, Washington, D. C.

Verne L. Harper, assistant chief in charge of research, U. S. Forest Service, Washington, D. C.

George B. Hartman, head of the Department of Forestry, Iowa State College, Ames, Iowa.

Walter H. Meyer, professor of forestry, School of Forestry, Yale University, New Haven, Conn.

Bernard L. Orell, vice president, Weyerhaeuser Company, Tacoma, Wash.

Arthur W. Sampson, professor emeritus , School of Forestry, University of California, Berkeley, Calif.

Francis X. Schumacher, professor of forestry, School of Forestry, Duke University, Durham, N. C.

Henry J. Vaux, dean, School of Forestry, University of California, Berkeley, Calif.

Harold G. Wilm, commissioner of conservation, New York Conservation Department, Albany, N. Y.

The 59th Annual Meeting

HELD IN San Francisco, Calif., November 15-19, 1959, the 59th annual meeting of the Society of American Foresters drew a total of 1,400 registrants. Of this number 1,075 were members and guests, 325 were ladies.

Three days of formal meetings, held at the Sheraton-Palace Hotel, November 16-18, included a general meeting, a Society Affairs session, and nine technical Division meetings. The Council of the Society held an all-day business session on November 15, and the Committee for the Advancement of Forestry Education and the Committee on Log and Tree Grades met. A joint business session of the Council and Section delegates was held on the evening of the 15th.

The General Session

Samuel H. Bryan, chairman of the Northern California Section of the Society, served as chairman of the general session, held on the morning of November 16. After welcoming remarks by President George A. Garratt, the theme of the meeting, "Forestry and People," was launched by the following speakers: Charles A. Connaughton, regional forester of the California Region of the U. S. Forest Service, discussed "The Impact of Population on Forest Management." "Industry Responsibilities and Vulnerability to Population Growth" was explored by Clarence W. Richen, manager of the Northwest Timber Department of Crown Zellerbach Corp., Portland, Ore. Dean Henry J. Vaux of the University of California School of Forestry spoke on "Twenty Years of Population Growth and Forestry Advances."

Society Affairs

The annual business session of the Society, conducted by President Garratt, included reports of officers, staff, and committees. This was followed by a panel discussion, moderated by Vice President Henry J. Malsberger, of "State Registration and Licensure of Foresters." All reports and the papers presented in the panel discussion will be published in the Society Affairs section of the February issue of the JOURNAL.

Division Meetings

Nine subject Divisions of the Society held technical sessions as follows: On November 17 the Division of Silviculture held an all-day meeting; while the Divisions of Forest Products, Forest Recreation, Economics and Policy, and Forest-Wildlife Management met for half-day periods. The Division of Forest Management met all day November 18; the Divisions of Education, Range Management, and Watershed Management met for half-day sessions.

Social Events and Awards

The annual Society dinner, with a capacity attendance of 820 persons, was held on the evening of November 18. William D. Hagenstein served as toastmaster. An award was presented by President Garratt to Francis X. Schumacher of the Duke University School of Forestry, Durham, N. C., for outstanding achievement in biological research leading to the advancement of forestry. (See following page.) In the banquet address Dr. James H. Shoemaker, vice president of the Bank of Hawaii, Honolulu, chose for his topic "Our New Western Frontier."

Widely acclaimed ladies' activities during the meeting, under the guidance of Mrs. DeWitt Nelson, were highlighted by a day long train and bus tour of the Monterey Peninsula.

Numerous alumni groups held get-togethers throughout the period of the meeting.

Field Trip

Thursday, November 19, was devoted to a field trip designed to acquaint visitors with some of California's forest practices, forest types, and the changing pattern of forestry brought on by population pressures. Some 320 men were taken on a tour of the Santa Cruz area south of San Francisco, the day including a hearty lunch in Henry Cowell Redwoods State Park

GENERAL meeting chairman Samuel H. Bryan, *center*, is shown with SAF president, George A. Garratt, second from *left*, and keynote speakers at the general session: Dean Henry J. Vaux, *left*, Charles A. Connaughton, second from *right*, and Clarence W. Richen.

and a visit to the park's stand of virgin redwood.

Committees for the Meeting

It would be impossible to list all those who contributed toward making this one of the outstanding meetings in the history of the Society. General chairman John Callaghan, Keith Arnold, chairman of the Program Committee, and B. H. Payne, chairman of the Committee on Arrangements, can be singled out as representatives of the many workers to whom the Society owes its thanks.

Society of American Foresters Presents Award at Annual Meeting

Presentation of an Award to
Francis X. Schumacher
for Achievement in Research
by George A. Garratt, President
Society of American Foresters
at San Francisco, California
November 18, 1959

Five years ago a most generous donor who prefers to be anonymous made a grant of $10,000 to the Society of American Foresters. The purpose of the grant was to institute awards "in recognition of outstanding achievement in basic or applied research in any branch of the biological sciences, provided the research contributes, either directly or indirectly, to the advancement of forestry."

The nature of the award is a specially engraved plaque in the shape of our Society emblem, together with a cash honorarium.

Five previous awards have been made:

To Leo A. Isaac of Portland, Oregon, for research leading to improved silvicultural practices in Douglas-fir.

To Philip C. Wakeley of New Orleans, Louisiana, for experimental work in planting and in genetical improvement of the southern pines.

To Harold J. Lutz of New Haven, Connecticut, for outstanding contributions to our knowledge of forest ecology.

To C. Syrach Larsen of Denmark for valuable additions to the science of forest genetics.

And to Nicholas T. Mirov of Berkeley, California, for his investigations of the oleoresins of eighty species of pine.

Another distinguished American forester has been selected to receive the award, and I now have the honor and pleasant duty of presenting him to you. He is Professor Francis X. Schumacher of the Duke University School of Forestry at Durham, North Carolina.

Inspiring teacher, imaginative designer of research, lucid writer, Professor Schumacher has been selected in recognition of his pioneering work and his many valuable contributions in the application of statistics to silviculture.

Born in Dayton, Ohio, on March 14, 1892, he received the degree Bachelor of Science in forestry in 1921 from the University of Michigan, then studied for two years at the University of California.

During World War I, he served as captain in the American Expeditionary Forces. His military citations include the Belgian Legion of Honor, the French Croix de Guerre, the Purple Heart, and the Distinguished Service Cross.

He was a member of the faculty of the University of California School of Forestry during the period 1921-1930. In the latter year he went with the U. S. Forest Service in Washington, D. C., where as senior silviculturist he was in charge of the work in forest biometry. For the past twenty years he has served with distinction as professor of forestry in the Duke University School of Forestry.

During his academic career he has served also as collaborator to the Southeastern Forest Experiment Station and consultant to the Tennessee Valley Authority and to the U. S. Army Corps of Engineers, South Atlantic Division.

His literary contributions include papers in the JOURNAL OF FORESTRY, *Ecological Monographs, Plant Physiology, Journal of Agricultural Research, Biometrics Bulletin,* and other scientific journals. He is co-author with Donald Bruce of the well known textbook *Forest Mensuration* and with R. A. Chapman of the scholarly work *Sampling Methods in Forestry and Range Management.* During the period 1936-1945 he was associate editor of the JOURNAL OF FORESTRY for forest mensuration and experimentation.

Among Professor Schumacher's scientific honors are election to the grade of Fellow of the American Statistical Association and Fellow of the American Association for the Advancement of Science. Last February he received the senior achievement award of the Appalachian Section, Society of American Foresters, for outstanding contributions to forestry. And on May 24 he was awarded the honorary degree of Doctor of Science by North Carolina State College.

Professor Schumacher's pioneer work in statistics and experimental design has notably advanced the art and science of forestry. Moreover, the thoroughly schooled specialists he trained in the Forest Service and at Duke University have enriched the profession of forestry. Many American teachers of forestry statistics and numerous experiment station technologists are Schumacher-trained men.

It is now my great pleasure to present to this genial scientist, this fellow Member of the SAF, the Society of American Foresters award.

Professor Schumacher, in behalf of the Society and of the anonymous donor whose generosity makes this award possible, I present you with this plaque and this honorarium in recognition of your outstanding achievement in biological research leading to the advancement of forestry.

Missoula: Fire Headquarters

Arthur B. Meyer[1]

FORESTERS in the eastern United States, sweating on a fire line, know well the feeling of anger that comes from the knowledge that human ignorance, carelessness, or maliciousness are the chief causes of forest fires. They know also the very considerable efforts that have been and are expended in preventing man-caused fires.

There is a portion of this country in which the problem of fire cause is vastly altered from eastern conditions. The chief cause of fires in many regions of the West is lightning—a natural phenomenon that has through the ages provoked awe and fear in the minds of men and before which they have stood practically helpless. The fire fighter's defense has been to develop means of quick detection and speedy suppression. This he has done with good results, but the cause remains, unpreventable, predictable in occurrence only to a degree.

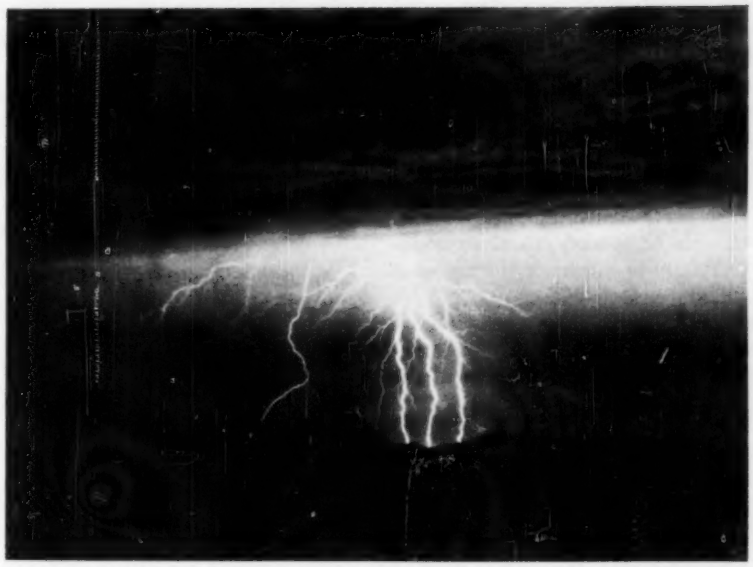

FIG. 1.—Lightning is the chief cause of forest fires in major portions of our western forests.

Strikes

During the dry month of July, 1959, the Northern Region[2] of the U. S. Forest Service had 161 fires of which 101 were man-caused.

On the night of July 31 there were lightning storms, unaccompanied by rain of any consequence. On August 1 the Region had 226 fires, followed by 61 on August 2, 39 on August 3, 14 on August 4, 10 on August 5. Of these 350 fires 16 were man-caused, the rest were the result of the one night's storm activity. Fortunately, the night was not immediately followed by others of a like nature.

On the first and second days 1,300 men were on fire lines. During the 5-day period reported upon, 195 smokejumper jumps were made on 60 fires, 58 TBM runs dumped 34,800 gallons of slurry (borate in water) on 47 fires, 39 cargo air drops were made varying from 500 to 4,000 pounds of supplies and gear. The Air Force ferried in 150 Black Feet Indians to control a fire in the Marshall Wilderness area. Morning and afternoon, observation planes droned over the mountains. Helicopters whirred about, picking up smokejumpers, ferrying crews into and out of inaccessible areas, scouting fires, and rescuing three injured men.

Of these 350 fires, 306 were suppressed at under ¼ acre (Class A), 40 at under 10 acres (Class B). Four fires totaled 770 acres. One of the four was burning into Forest Service protection lands on a wide front, having previously escaped control from another protection agency.[3]

The Northern Rocky Mountains

The U. S. Forest Service in its Northern Region (Region One) protects a gross area of 33,000,000 acres of forest and range land of which 24,622,000 acres are in national forest ownership on 16 national forests. Another 275,000 acres of national forest land is under cooperative agreement for protection by private associations, while the Service in turn protects

[1]The author visited Missoula, Mont., headquarters of U. S. Forest Service Region One, during the period July 30-August 8, 1959 for the purpose of reporting on progress in the Northern Rockies in the use of aerial facilities in fire control and the plans for research at the new fire research laboratory. Shortly after his arrival the season's most serious outbreak of lightning fires occurred. Circumstances required, or permitted, some adjustment of original objectives of the visit. The result is a generalized report which it is hoped will be of some value to foresters unacquainted with that Region, or those with a special interest in forest fire control.

All photos are courtesy U. S. Forest Service.

[2]Montana, Idaho north of the Salmon River, northeastern Washington, and northwestern South Dakota.

[3]Acreage figures were on-the-spot estimates, subject to later adjustment, but sufficient for the purposes here.

lands of other federal and state agencies and private owners.

Sharp contrasts exist in this big country. Altitudes vary from 700 to 12,000 feet, annual precipitation from 5 to 50 inches. Vegetation runs the gamut of grasslands, mixed forest and range, and dense timber. East of the Continental Divide fire occurrence is relatively low but flashy fuels are common. West of the Divide, where most of the Region's forest land is concentrated, lies some of the roughest country in the United States, with high fire occurrence and heavy fuels over much of the area, although fuels vary from dry sage to subalpine forests fringing year-round snow fields.[4]

"More than 70 percent of all fires in this Region are caused by lightning. In one 10-day period in July 1940 the all-time record of 1,488 lightning fires started on the national forests" of the Region.[5]

Vastly compounding the problem of suppression of fires that are started by an unpredictable cause, and that may ignite 300 fires in a night over the Region, is the nature of the terrain. Suffice it to say that here are The Mountains of song and story, vast, precipitous, remote, inaccessible, devoid of habitation for mile on mile.

Flexibility is the most fundamental requirement in the design of fire control systems. This is a principle of long standing.

That the design of fire control in Region One is flexible is apparent. This flexibility is exemplified most strikingly by the adaptation of the speed and mobility of aerial operations to its work. It is demonstrated less obviously but just as surely by the retention of every tool or procedure that the past history of fire control has shown to be valuable in a given set of circumstances.

The figures presented in Table 1 speak for themselves and for the work of the many men who have contributed to the progress they represent.

TABLE 1.—SUMMARY OF FIRES IN THE NORTHERN REGION, USFS[1]

Period	Average annual acreage burned
1905-1930	252,000
1931-1940	70,819
1941-1957	7,406

[1]Source: Region One, U. S. Forest Service, Division of Fire Control.

For emphasis, the three stages of progress represented in this table could be said to represent the age of the pioneers, the age of manpower, and the air age. Each has had its accompanying progress in the development of techniques, communications, equipment, administration, funds, public backing, and technical knowledge.

Detection

During the 1959 season the Region manned 250 permanent lookouts. A study conducted some years ago shows that before the current combination of air-ground detection, lookout observers accounted for 60 percent of first discovery reports. After air patrol developed into a practical tool, ground observers caught 37 percent.[6]

Ground observers retain their value in that they are more efficient in detecting fires that smoke up quickly after origin. They provide measurements of weather factors influencing the spread and control of fires in the area. They provide detailed information to aerial observers on the path of lightning storms and areas where the most lightning activity occurred. They provide communications and a "safety watch" on the progress of airplanes in the event of motor failure. They materially assist the air observer in obtaining accurate locations on fires detected while on patrol.

One lookout in the Flathead National Forest on the night of July 31 watched countless strikes at a distance, recorded 15 in his vicinity, probably missed 100 more in the same radius. Three of the recorded strikes ignited fires for which the lookout was credited with first, and early, detection.

Air observers supplement the ground lookouts. Their observation position is extremely mobile and it is quickly placed in the most effective position for detection of forest fires. The patrol routes, planned in advance for coverage of areas "blind" to fixed detectors, are adjusted currently to cover lightning storm areas as directed.

The combination of planned ground-air detection has proved to be more efficient and more economical than other known detection systems.[7]

Ground Attack

Reference to the earlier summarization will indicate aerial attack or supply was involved on 146 of the 350 fires during the 5-day period reported upon. This should serve to gain a proper perspective of the relationship of the old and the new in fire control, lest one assume that the tried and true in suppression methods have been superseded. They have not; they have been augmented.

The Region employs vehicular ground transport and heavy mechanical suppression equipment wherever possible. As in practically every situation anywhere, fire suppression is basically attained by men with appropriate tools on the fire line.

The purpose here is not to report on the tried and true. Neither, however, is it, by neglect, to foster the impression that the new has taken over from the old. First attack crews on fires arrive equipped with two old standbys—the Pulaski tool and a shovel. The Region during 1959 maintained strings totaling 860 head of pack animals and riding horses. Most of the pack stock were mules.

This latter fact, probably more than any other, is symbolic of the

[4]Barrows, J. S. Forest fires in the northern Rocky Mountains. Northern Rocky Mountain Forest and Range Expt. Sta. Paper No. 28. 1951.

[5]Colson, DeVer. Thunderstorm analysis in the northern Rocky Mountains. Intermountain Forest and Range Expt. Sta. Research Paper No. 49. 1957.

[6]Barrows, op. cit.

[7]It might be interesting to mention that the detailed planning methods and operational techniques for the combined ground-air detection systems now used extensively in Region One and elsewhere were first developed in 1945-1947 on an experimental area of over 2 million acres of remote wilderness lands. The project was called the "Continental Area Experiment."

conditions of terrain and accessibility facing fire control organizations in many parts of the West which have been a primary motivating factor, though not the sole one, in the initiation and continuing development of air operations.

Aerial Operations in the Work of Fire Control

It is easy to see in the mountain country why, even when aviation was young, foresters thought of adapting its capabilities to the tremendous task of fire control operations.

Shortly after World War I, Forest Service Chief Henry S. Graves sought and secured the cooperation of the Army Air Corps in first investigating and then operationally using aerial patrol. It was initially used in California, later extended to Oregon, Washington, Idaho, and Montana. A prominent name in the early history of these activities was Colonel H. H. (Hap) Arnold.

Aerial patrol in Region One dates from the summer of 1925.

Concurrently with flight for direct observation, aerial photography during the period 1925-1935 expanded from the experimental to the practical stage. It has, of course, now been adapted to uses far beyond those serving fire control.

In 1929 the first operational drop of cargo from an airplane to supply fire fighters was made. Within half a decade this became a practical means of supply for back country fires.

In 1935 the Forest Service initiated the Aerial Fire Control Experimental Project to study the possibilities of bombing fires with chemicals and water. This experimental work was discontinued in 1939 in favor of other experiments to determine the feasibility of transporting men to fires in mountain terrain by airplane and parachute.

The latter experiments were carried out by a private parachute manufacturer and professional jumpers, though toward the close of the first season Forest Service personnel on the project made jumps into both open and timbered areas. The experiments were conducted at Winthrop, Washington, on the Chelan National Forest.

It was concluded that jumpers could land safely in both green timber and open areas. However, larch and alpine fir types, mature stands of timber, and areas having snags were recognized as undesirable for smokejumper landings.

The following season both Region Six and Region One established a small squad of smokejumpers on a trial basis. The first actual fire jumps in the history of smokejumping were made on July 12, 1940 by Rufus Robinson and Earl Cooley in the Nezperce National Forest. (The first rescue jump by smokejumper was made three days later by Chester N. Derry to an airplane crash in the Bitterroot Forest—a continuing humanitarian service of the jumpers.)[8]

Region One Air Operations

Dedicated by President Eisenhower in September, 1954, the Aerial Fire Depot at the Missoula County Airport is impressive physical evidence of the age of air in forestry. The functions it serves are not limited to, but are to a great extent devoted to fire control.

The inherent mobility and far-reaching effectiveness of aerial operations complicate an understanding of the scope of their functions or of the manner of their coordination with "ground operations."

In so far as fire control is concerned, it is easiest to think of the facilities of the Depot as representing a "second force" that stands ready to supply either the first, quick strike or to vastly augment the gruelling staying power of ground operations in combating fire. This applies first to Region One, but second to the entire West when conditions demand exchange of aid with other areas.

(Furthermore, as land manager of extensive holdings as well as a federal, public agency, the facilities of the Forest Service stand ready to serve the public in either widespread or individual instances of disaster or danger to life and welfare. A most dramatic and recent example of such a function is the part played by the Forest Service in reconnaissance and search and rescue operations in the Montana earthquake disaster of August, 1959.)[9]

Functionally, the Depot consists of a training, housing, and dispatching center for smokejumpers, as the center of administration of aerial operations, as a center of supply for fire fighters, and as an equipment development and inspection center.

Administratively, the Center represents an umbrella of forestry air power that is spread over the 16 national forests, the 101 ranger districts of the Region. A lookout may instigate a request for airborne first attack; a fire boss may call for reinforcements and supplies.

This mobile striking arm of fire control, under the direction of Regional Forester Charles L. Tebbe, is the responsibility of Chief E. R. DeSilvia of the Division of Fire Control, aided by his air operations officer, L. M. Stewart, who in turn coordinates his activities with the regionwide situation as evaluated by the Regional dispatcher, Fred Fite. The dispatcher is the coordinator of air and ground operations.

There was once a time when the Regional chief of the Division of Fire Control, symbolically at least, could do little during a rash of fires on the Region but bite his fingernails, wait for reports, and hope that presuppression measures had been sufficient to cope with the situation.

Improved communications and air operations have changed that. Through the "regional radio net"

[8]The foregoing historical highlights were taken from "History of Smokejumping," a mimeographed publication of USFS Region One, Missoula, Mont. 1959.

[9]Hebgen Lake-Madison River Earthquake Disaster. Region One, USFS, Missoula, Mont. Aug. 1959.

the forests are in close touch with each other and with Regional headquarters. They can gather and forward current fire information promptly and request aerial support when needed. The chief can get a crew of 16 equipped men or 4,000 pounds of supplies and equipment to the farthermost fire in the Region in about the same time it takes a pack horse to climb 3,000 feet in 5 miles. Over the mass of the Region's timberlands, concentrated in its western portion, the chief can do so in varying fractions of this time. Coordination, mobility, and team action are obvious advantages.

Contract flying.—Early air operations of the Forest Service, both on an experimental and an operational basis, were mostly carried out with the cooperation of the Army Air Corps, with certain exceptions in which Service owned planes were used.

At Missoula the Service owns two planes, a Twin Beechcraft and a Cessna 180.

In the bulk of fire fighting operations, planes and pilots are under contract with private owners, corporate or individual. The primary contractor at Missoula is the famous Johnson Flying Service, which has made many contributions to developments and progress in forestry air operations.[10] This company in 1959 had available under formal contract (exclusive availability) 24 fixed wing airplanes in eight distinct size and performance classes. These included Cessna 180's, a Piper Commanche, Travelair, Ford Tri-motors, twin Beechcrafts, TBM's, a DC-2, and two DC-3's (C-47). Five of these craft were stationed at McCall, Idaho, in USFS Region Four. Under separate contract Johnson also supplied two Bell helicopters.

Under contract with other owners than Johnson in the Region were 20 fixed wing planes for use in fire reconnaissance, based at the various forest headquarters, plus 16 fixed winged craft and 3 helicopters under agreement for emergency use.

[10]White, Dale, and Larry Florek. Tall timber pilots. Viking Press. N. Y. 1953.

FIG. 2.—A TBM drops its load of slurry in fire suppression action.

Aerial reconnaissance.—The use of aircraft for the first detection and for further observation of fires is too well understood to require more than passing mention as an important function of forestry air operations. It is an extension of the detection network and an aid in planning and directing suppression activities. In Region One it is dispatched from the individual forest headquarters.

This is the oldest practically applied use of aircraft in forestry.

Aerial dispersal of retardants.—As previously indicated, direct attack on fires by the dropping of water or retardants was first investigated in 1935 by the Forest Service but discontinued in favor of experimental smokejumping.

In 1947 cooperative studies with the Air Force proved it feasible to drop bombs containing chemicals or water on going fires, the containers bursting on contact. Such direct suppression procedures were, however, judged to be prohibitively expensive. Then experimental work carried out in 1955 in Operation Firestop in California showed that there were promising possibilities for cheaper but satisfactory results by applying the free fall (cascading) of chemicals, as contrasted to container bombing.

During the past summer Region One employed TBM's and a Ford Tri-motor as aerial tankers to drop retardants on going fires. Planes carried 3-compartmented tanks, each compartment of which was triggered separately. The capacity of each compartment on a TBM was 200 gallons; on a Ford, 100 gallons.

The retardant primarily used was sodium calcium borate. The soupy mixture of borate and water, called slurry, cost 35¢ per gallon. Principal use in this Region, on an operational-experimental basis, was in first attack. Density required for effective coverage of slurry varied widely with fuels and burning conditions. Dropped from 75 to 100-foot heights, the slurry of each 200-gallon compartment could lay an effective fire retardant strip approximately 250 feet long. Ideal air speed was reported to be 110 to 130 miles per hour .

Drops of retardant are found to be more effective when applied during early morning or late evening hours, at which times full advantage can be taken of maximum air densities and minimum turbulence. Drops can be made during the heat of the day, but may necessitate load reduction after a careful check of the target area for air turbulence.

Ideally, the 3-compartment tanks permit laying a triangle of retardants to surround a small fire or criss-cross patterns on spot dropping. To some extent in this Region, and with greater emphasis elsewhere, aerial application of retardants to slow portions of fire perimeters has been used.

Results at Missoula while the season was in progress were judged as "relatively good in effectiveness and accuracy." We may expect further and detailed reports on this dramatic development in the use of aircraft and chemicals.

Cargo dropping.—First used operationally in 1929, cargo dropping of supplies and equipment to fire fighters is, next to reconnaissance, the oldest use of aircraft in fire control. Its capabilities may be judged by the fact that the same method is used to deliver structural timbers for lookout towers on the winter snows of mountain tops.

In the Region's "dispatcher's

catalogue" a DC-3 is rated for 4,000 pounds of para-cargo and a DC-2 3,500, plus cargo chutes. Smaller craft are used when the weight and bulk permit.

On an observed run the DC-2 had 3,741 pounds of cargo, including everything from six 30-man-1-day rations to two chain saws and a radio unit. Cargo was packaged into approximate 100-pound bundles. When the fire was reached the pilot circled it and located the drop marker on a ridge top. The drift streamer was dropped and the plane went into a series of tight circles 500 feet above the trees on the ridge. The cargo dropper had affixed cargo chutes to each package and on each circle, upon buzzer signal from the pilot, pushed two packages out the open door of the plane. The chutes opened immediately from the jerk of the rip cord—static line connection and the packages tumbled onto the sparsely timbered ridge, a few catching in tree tops.

The cargo dropper was a smokejumper of some years' experience, a Forest Service employee—the pilot and co-pilot, Johnson employees.

Smokejumping.—When it was demonstrated that it was feasible to parachute fire fighters into the back country of the mountainous West, air transport began what is probably its greatest contribution to date to the work of fire control. This for the reason that trained and properly equipped manpower remains the first requirement of fire suppression, speed of arrival its measure of success.

Because of the glamorous and adventurous aspects of smokejumping, which are real enough, a basic feature of jumper success is sometimes obscured. By training and physical stamina jumpers are topnotch fire fighters, and proud of it.

Beginning with 12 jumpers in 1940, the Forest Service throughout the West averaged a yearly seasonal total of 320 in the 1955-1958 period. In 1959 this figure was over 360. During the previously mentioned 4-year period each jumper averaged an annual 9.2 official jumps per season.

Because of their exceptional mobility smokejumpers can be and often are shifted over wide areas as the need demands in the western fire season. During 1959 the Forest Service maintained smokejumper crews at Missoula, Mont., Grangeville, McCall, and Idaho City, Idaho, Silver City, N. Mex., Redding, Calif., Winthrop, Wash., and Cave Junction, Ore. The National Park Service had a small base at West Yellowstone, and the Bureau of Land Management one at Fairbanks, Alaska.

Of the 129 jumpers regularly based at Missoula this season four were financed by Glacier Park.

Recruits must be between the ages of 18 and 28 years, have a satisfactory physical report, good recommendations, and at least one year's previous fire fighting experience. Their weights must fall between 130 and 180 pounds and their vision must be 20-70 or better, without glasses. New jumpers undergo a vigorous four weeks of classroom and field training at the Center in Missoula starting in mid-June. This consists daily of one-half day on fire fighting, one-half on physical fitness and the techniques of parachute jumping. During the last seven days of the period one actual jump is made per day, each progressively more difficult.

On completion of training, all but a skeleton crew of jumpers are dispatched to various points and are assigned to routine forest work until needed.

Approximately 80 percent of jumpers are college students, fire season coinciding in general with summer vacation periods, 10 percent are full-time Forest Service

Above

FIG. 3.—Modern progress aids but has not replaced the man on the fire line with hand tools.

Right

FIG. 4.—Smokejumper suit and equipment are designed for maximum safety for the jumper.

employees. In the 1959 season 35 of the total jumpers at Missoula were forestry students.

At Missoula a skeleton crew of 20-30 jumpers is permanently maintained during season, but is quickly brought to full complement when fires break. Jumpers then, as during training season, live in the new dormitory capable of housing 100 men. The hub of smokejumper activity is the adjacent building called the parachute loft. Here jumper gear is checked and assembled for quick loading; parachutes dried, cleaned, repaired and packed; and the dispatching headquarters and general offices are maintained. Across the loading ramp for aircraft, the warehouse maintains at all times an array of equipment, including rations, capable of supplying 5,000 fire fighters.

The smokejumpers are a part of what is officially called the Parachute Project (under the Regional air operations officer). This name is apparently a holdover from the days when jumping was an experimental project. The Project has a superintendent, currently pioneer smokejumper Earl Cooley. Under him two veteran jumpers serve as chief foreman, one primarily concerned with fire training, organization, dispatching; the other with parachutes, related equipment, and jump training. Six foremen then have an assortment of administrative duties serving also as jumping foremen on drops of 16 or more men. Squad leaders, in turn, handle crews of up to 16 men.

An experienced man and a first-year man are paired on 2-man fires, which account for 70 percent of the fires jumped. Normally, even numbered crews are dropped (from two to 16, the latter being the capacity of the largest plane, the DC-3).

The smokejumper's outer protective clothing is shown in Figure 4. He is equipped with a 28 or 30-foot, slotted back-pack chute and a 22-foot emergency chest-pack chute. His individual fire pack, which follows him to the ground after he has safely landed,

FIG. 5.—Jumper orange and yellow chutes have about replaced this earlier model of the white chute.

contains a shovel, a Pulaski tool, 6 USFS rations augmented with juices, a flashlight with extra batteries, a first aid kit, a file, salt tablets, can opener, canteen, and paper sleeping bag. Additional equipment dropped for two men is a 5-gallon can of drinking water, a set of climbing spurs (for retrieving parachutes from trees), a crosscut saw, 2 seamless sacks for carrying out gear, and a water bag. Other equipment, such as radio, may be dropped at the jumper's request when landed. Altogether the individual has about 75-80 pounds of gear which he is instructed to retrieve from the fire by carrying it out on foot to a maximum distance of 6-8 miles if there is no other method of return.

The crew leader is equipped with

FIG. 6.—Jumper prepares to detach himself from parachute harness and descend to the ground by nylon tubular webbing carried for that purpose.

a compass and a map of the area of the fire showing its location, and bearing instructions as to egress from the area after fire suppression.

Smokejumping is the present day ultimate in flexibility, mobility, and adaptability to the needs of the circumstances.

The air dispatcher is by telephone and radio relay in direct contact throughout the Region. He orders the cargo drops, the jumper runs, on request, as balanced against regional needs and available manpower and facilities.

The procedure on jumps varies by fires and by the aircraft used to deliver the jumpers. At 9:00 a.m. on August 4, a Johnson Flying Service DC-3 taxied up to the Parachute Loft Building at the Aerial Fire Depot, adjacent to the Missoula airport. Four jumper fire packs were loaded. Four young men swathed in their jump suits, looking like over-padded football players, and bent over at a 30 degree angle by the harness of the parachutes, waddled up and climbed in. A jumper foreman, serving as spotter, checked equipment. The plane, stripped for cargo dropping, had no seats and the jumpers sat spread eagle on the floor amidships. The plane took off, the sloping floor leveled and the wind whipped in the aperture near the tail where the door would have been mounted had it not been previously removed. The jumpers sat quietly, each with his own thoughts. When the area of the fire was reached the plane lowered altitude and circled. By this time the spotter, wearing a manually released parachute, was sprawled on his stomach with his head sticking out the door so that he could observe the ground without the obstruction of the wing. The crew leader studied the terrain and the fire. The other three jumpers sat quietly.

Flying at about 1,800 feet above treetops the plane made an additional pass or two as spotter and crew leader studied the ground, and then the spotter dropped his streamer to test drift. Noting its fall in relation to the selected drop

spot, he then directed the pilot to adjust his flight line to compensate for drift. The crew leader stood at the door, a hand braced at each side. Directly behind him stood his jumping mate. Lines from their back-pack chutes were snapped onto the overhead static line. As the plane made its adjusted run, the spotter, still prone on the floor, slapped the leg of the crew leader and almost in the same motion that of the man behind. One, two, they were out. One, two, lines snapped loose from the parachute packs and the chutes streamed upward and then snapped open in an orange and white half-globe, the jumpers swinging below. By the next time around they had landed, one on open ground, one in the top of a stand of pines. The other two jumpers were ready and left the plane. The spotter hastily dragged the fire packs with their cargo chutes to the door. Within a few minutes there appeared on the ground the LL of orange streamers which meant all jumpers had landed safely. The pilot lowered to 250 feet and the spotter shoved the packs out two at a time per pass over the cargo drop spot previously agreed upon by crew leader and spotter.

In a packet sewed to the leg of the jump suit smokejumpers carry a roll of nylon tubular webbing, 100 or 125 feet long, depending on local height of mature timber. They get out of trees when their chutes are lodged in higher branches by threading this "let down" webbing through the chute harness, unsnapping themselves from the harness, and lowering away.

The jump suit has two primary purposes: to provide special padding for the jumper's vulnerable points in ground landings and general protection to prevent injury in treetop landings.

In the history of Forest Service smokejumping there have been more than 40,000 jumps made and no fatalities from jumping. An observer, nevertheless, does not observe a jumper drop without a qualm or two.

Equipment Development

The Equipment Development Center at Missoula, a Section of the Division of Fire Control, is housed partially at the Aerial Fire Depot, partially in a downtown shop. About half the work it performs is of nationwide application, the remainder of special application to Region One.

The work of the Center is primarily concerned with the specialized tools and equipment used in aerial fire control—as contrasted to aircraft specifications which are in the domain of the Federal Aviation Agency. Staff members are quick to say their work is not

FIG. 7.—Ten-man disposable mess outfit. Adaptation of equipment to the needs of aerial fire control activities is a primary duty of the Equipment Development Center at Missoula.

research, and in the strict sense it is not. It deals primarily with the adaptation of existing materials and equipment to specialized uses and needs. Close contact is maintained with suppression forces and several of the 8-man staff are smokejumpers.

On a Service-wide basis the Center is responsible for the preparation of specifications on all air equipment (other than aircraft) and for inspection of parachutes and related equipment to determine that required standards are met. Safety equipment development is of primary concern. Developed by the Center and soon to be in regular use is a new jumper suit which weighs 7 pounds compared to the present weight of 16 pounds. The new suit is buoyant. A jumper who parachuted into Hungry Horse Lake submerged about 4 feet and then popped to the surface. The Center developed the comparatively new paper sleeping bag which can be disposed of after use. The bag is now commercially available. Developments in packaging and aerial delivery receive considerable attention, such as low cost multiwalled fiber cartons, energy absorbing pallets, a disposable perforated diaphragm that may for some items replace the more costly cargo chutes. The Center is turning its attention to light mechanically powered forest tools that can be delivered by air, but which might well, of course, have other applications. Other projects of the Center vary from evaluating camping and survival gear developed by manufacturers to development of training equipment for the jumpers.

Forest Fire Research

Research in the nature of fire and the fire problem is not new at Missoula, having been carried on there for a number of years by the Division of Forest Fire Research of the Intermountain Forest and Range Experiment Station. This work, under the direction of J. S. Barrows, is now entering a new stepped-up stage.

In 1958 Congress enacted legislation permitting the Forest Service to embark upon a long planned program for the development of forest fire research laboratories. The physical plant for one laboratory was completed at Macon, Ga., in the autumn of 1959. Erected by the State of Georgia, this Southern Forest Fire Laboratory will be equipped and operated by the Southeastern Forest Experiment Station. The second laboratory is under construction by the Forest Service and scheduled for completion in June, 1960 at Missoula. Known as the Northern Forest Fire Laboratory, to be operated by the Intermountain Station, the $900,000 research facility wil be adjacent to the Aerial Fire Depot and Smokejumper Center. A third laboratory is planned for location in California.

Research at the laboratory will come under two broad categories: (1) basic and applied research on assigned problems of nationwide

interest; (2) special regional research on the forest fire problems of the Intermountain West and Alaska. Examples of nationwide problems which the laboratory will be equipped to investiate include basic studies in fire physics, fire chemistry, forest fire meteorology, fire detection, fire suppression, and the formation and behavior of lightning storms. Specifically, the four branches of research to be carried out are labeled Fire Physics and Engineering, Fire Behavior, Forest Fire Meteorology, and Fire Control.

The laboratory will include a combustion chamber, low and high velocity wind tunnels, both with temperature and humidity controls, instrument development and calibration rooms, physics, chemistry, and meteorology laboratories, fire equipment research shops, a library, and a photographic laboratory. A radar room will be included for use in conjunction with a new U. S. Weather Bureau radar unit being installed on an 8,000-foot peak above the laboratory. As both an operational and research tool the radar will detect, track and assist in the analysis of lightning storms over a 250-mile radius covering the headwaters of the Columbia and the Missouri Rivers.

In this day of atomic submarines and moon rockets no thinking person will discount the potential values of scientific research. There is no reason to suppose that its capabilities are any less in the fields involved in knowing the nature of fire, its causes, its prevention, and means for its control than in other branches of human knowledge.

There could be no more imagination-catching search underway than one that is labeled Project Skyfire by the research workers at Missoula. Directed by Forest Service meteorologists with assistance from several other agencies, this colorfully named project seeks to obtain information on the occurrence and behavior of lightning storms and their forest-fire-igniting characteristics. The ultimate goal is to develop improved methods for lightning fire suppression.

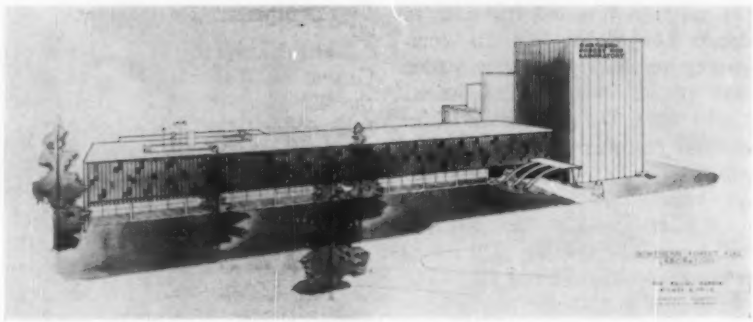

FIG. 8.—Artist's sketch of the Northern Forest Fire Laboratory scheduled for completion at Missoula in June, 1960.

Four field observation posts in an area of high lightning occurrence have been established. In a three-year program of investigation these posts are being manned during the summer electrical storm season (July and August) and personnel operate recording instruments and radar equipment to gather the desired information. The movement of storms is tracked. Time-lapse photography is used to determine the location and growth rate of cumulus clouds; a system of synchronized electric field meters is employed to measure the vertical component of the earth's electrical field. Temperature, relative humidity, atmospheric pressure, surface wind speed and direction, and the visual location of lightning strikes are recorded, as are hourly records of local weather and daily precipitation in the form of rain or hail.

(In addition, the Physical Science Laboratory of the Weather Bureau is conducting studies in the same area which may yield much basic knowledge of lightning.)

Simultaneously experiments are being conducted to determine if cloud seeding with silver iodide has any effect on lightning in storms. Paired storms, under as nearly uniform conditions as possible, are used. One is seeded, one is not, and their behavior is recorded.

Scientists on the project are quick to set any layman straight on scientific objectives. Said one: "If the project can specify the smallest cloud that will produce lightning it will have attained an important goal." Said another, in effect: "We do not expect to secure any knowledge that will revolutionize man's ability to cope with lightning-caused forest fires. We do hope to gain knowledge that may help in using present storm prediction, fire detection, and fire control facilities to better advantage."

Conclusion

Forestry has made great progress in the past half century in the prevention and control of forest fires.

That progress, however, leaves no room for complacency. There is the prospect of increasing risk of fires from vastly increased human use of the forests. The prevention of man-caused fires remains a never ending problem. Too little is known of the nature and control of "blow-up" fires which account for major losses. Greater knowledge of the nature of lightning, as a causative agent, is urgently needed. Continuing progress must be made in adapting each new scrap of knowledge, each new development in equipment or technique as a work-a-day tool of fire control forces.

Much needs to be done, yes. An observer at Missoula notes the wide diversity of activity and can but conclude that much is being, and will be, done. But most vivid of all is the impression of unity of purpose. The swinging Pulaski and the circling radar are used toward a common goal.

Net Tree Measurement

Donald J. Morriss

THERE is wide variance in the acceptance of tree measurement systems by both buyers and sellers of stumpage. This is a reflection of past custom, system reliability, and ease of application. Lexen[1] has described in detail the advantages of systems where the estimated volumes of standing trees are subsequently corrected by factors derived from sample log scales made during cutting. Elimination of the necessity for factor scaling will give the further advantages of reducing both measurements costs and interference with logging.

Reasonably accurate net volumes of uniform timber may be estimated by application of local net volume tables to only one or two measurements, such as d.b.h., or d.b.h. and the merchantable height. However, this requires strict attention to avoid use of tables for timber that differ from the timber on which they were based. Also, there will often be the expense of preparing a rather large number of net tables.

By taking into account each of the major factors which make up volume, net tables suitable for wide application may be constructed. These factors are diameter, used length, shape, and the amount or proportion of usable sound material. Diameter and length of standing trees are readily and accurately measurable; shape and soundness are not. Fortunately, tree shapes are so closely associated with diameter and height that they may be accounted for without measuring. The extent of defect cannot usually be determined with acceptable consistency between timber markers. Markers can, however, consistently classify trees as either having or not having external indications of defect. This separation may easily be shown in separate defect class tables based on careful log scale.

Once made and checked these net tables may be used for either tree measurement or sample tree measurement. Table construction and both applications are discussed below. It should be noted that only elementary statistical processes are used.

Field Data Collection

To attain a practical accuracy, field measurements should be made of about 400 trees of each major species (about half in each of the defect classes described below). The area of coverage should be decided in advance, if possible. In the Southeast, at least, it may be as large as a geographical region. Resulting volume tables should be used only in the area of data collection, unless later adjusted to fit other areas. Trees of minor species should be measured as they are encountered. Measurements must be by the best qualified available

TABLE 1.—AVERAGE PERCENT DEFECT AND RELATION OF NET TO GROSS VOLUMES IN NORTH CAROLINA TIMBER

Species[1]	Average percent of defect		Relations of net to gross volumes (X)	
	Apparently sound table trees	Obviously defective table trees	Apparently sound table trees	Obviously defective table trees
Southern Appalachians:				
Ash (cucumber)	5	30	.977x+23	.788x−46
Basswood	9	30	.822x+29	.592x+47
Beech (black cherry)	8	33	.939x−5	.549x+24
Birch (hickory)	15	43	.983x−39	.515x−18
Black gum (Sourwood, sweetgum)	15	38	.858x−2	.597x+5
Buckeye	21	50	.761x+10	.349x+73
Chestnut	9	40	.862x+17	.535x+34
Hemlock[2] (spruce)	2	30	.974x+7	.671x+26
Sugar maple	6	31	.892x+20	.601x+45
Red maple	9	34	.839x+20	.700x−5
Black oak (locust, southern red oak)	7	20	.975x−13	.752x+14
Chestnut oak (post oak)	10	32	.893x+2	.730x−19
Northern red oak	5	22	.938x+5	.708x+38
Scarlet oak	5	28	.939x+2	.612x+21
White oak (butternut)	7	26	.905x+8	.875x−48
Yellow poplar (wahoo)	5	28	.921x+15	.676x+41
Shortleaf pine	7	23	.898x+10	.743x+11
Pitch & Table Mtn. pine (loblolly pine)	6	26	1.022x−16	.936x−32
Virginia pine	7	29	.868x+10	.660x+7
White pine	6	20	.947x−9	.819x−19
N. C. Coastal Plain and Piedmont				
Loblolly pine	6	19	.918x+5	.614x+49
Longleaf pine	2	17	.969x+7	.731x+8
Pond pine	6	31	.874x+6	.687x
N. C. Piedmont and Sand Hills				
Shortleaf pine	2	16	.918x+5	.614x+41

[1]Parenthesized species are of infrequent occurrence in timber sales.
[2]Shake no defect.
Basis: 10,000 trees.

THE AUTHOR is management analyst, Internal Audit Staff, Forest Service, U. S. Dept. Agric.

[1]Lexen, Bert. Sale of stumpage on the basis of tree measurement. Jour. Forestry 40:845-853, 1942; and The determination of net volume by sample-tree measuring. Jour. Forestry 45:21-32, 1947.

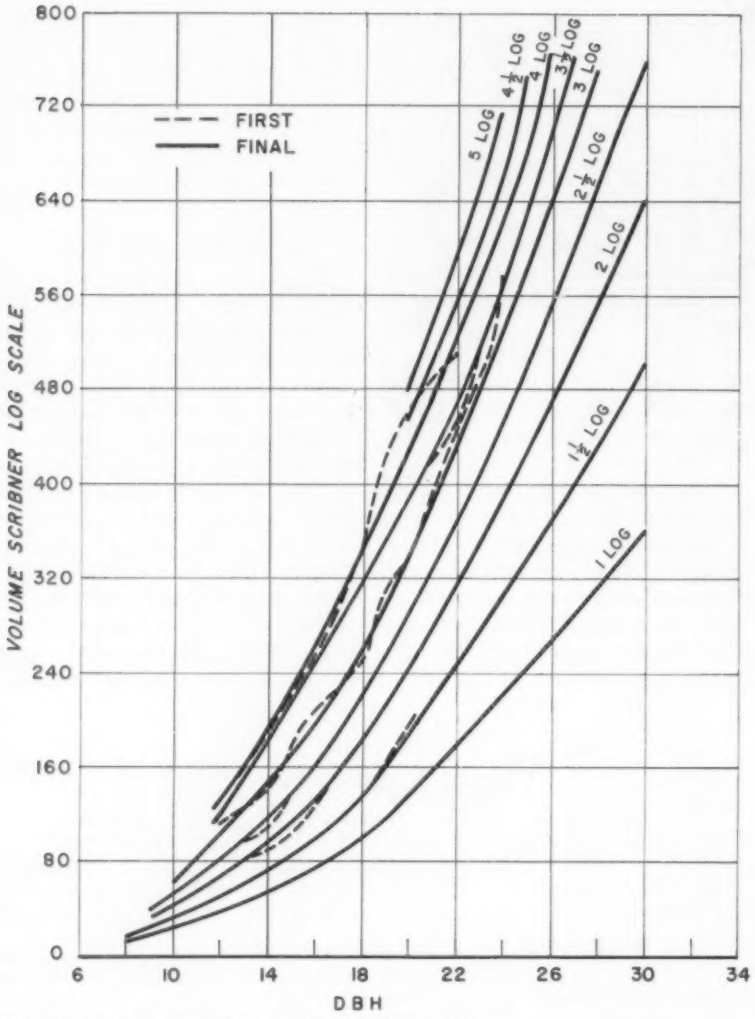

FIG. 1.—Volume curves, loblolly pine, northern Alabama.

TABLE 2.—TENTATIVE GROSS VOLUME IN BOARD-FEET[1] (SCRIBNER LOG RULE), BY NUMBER OF 16-FOOT LOGS, FOR LOBLOLLY PINE IN NORTHERN ALABAMA

D.b.h.	1	1½	2	2½	3	3½	4	5
9			43					
10		35	49	52				
11		45	58	68				
12		55	71	85	115			
13		65	86	105	128	124		
14	)	76	93	130	144	181	193	
15		87	107	140	180	218	226	
16		98	130	165	210	252	259	
17		114	159	197	229	287	300	
18		137	197	231	253	321	345	
19		167		265	310	351	427	
20		200		297	341	385	466	
21					383	419	490	
22	120				439	451	512	
23					504	514		550
24					580			

[1]Values read from first curves, volume over d.b.h. (by height classes).

scalers. They are best taken behind fallers over a reasonable spread of sites and tree sizes. Since it is in this initial step that accuracy of results is set, the following items to be determined and recorded are described in detail:

1. Species. While there will often be species combinations in final tables, accuracy is necessary because of the wide variation in form class and defect between species. If there is any doubt of the correct species of a tree it should be discarded.

2. Diameter. Diameter at exactly 4½ feet from the ground (d.b.h.) is taken to the nearest tenth inch.

3. Height. Merchantable height (equivalent to utilization practiced by efficient loggers) is recorded to the nearest tenth foot, to permit precise office segregation into half logs (including trim). Merchantable height is the sum of all log lengths plus any merchantable material which may be left in tops or long butts. The top cutoff point is to the commonly used merchantable diameter in smooth trees or to the first disqualifying limbs in rough trees (as in some hardwoods). Defect must be ignored in this measurement. To simplify later calculations, trees forked below merchantable height usually are best discarded unless the fork is low enough to permit measurement as two trees. In most timber the bias thus introduced is so small that it may safely be ignored.

4. Defect class. Each tree is classed as apparently sound or obviously defective entirely on the basis of indications of defect which could have been seen or determined by sounding when it was standing. Defect outside of the merchantable length or too small to result in a scale reduction is ignored. Crook is considered as a defect only if it could not have been eliminated in laying off the logs. Cull trees that a competent marker would inadvertently have marked for cutting are included. It must be remembered that both sound and defective net tables will allow for hidden defect. Defect measured in

apparently sound trees of several species is shown under "average percent of defect" in Table 1.

5. Scale. Careful gross and net scale is recorded. For each tree this will be the sum of the sections measured for merchantable height. A decimal rule may be used but unrounded values are better. It should be remembered that here is the opportunity to apply the work of a skillful scaler to large volumes which may later be measured by less skillful scalers. Standard, rather than rule-of-thumb, defect deductions should be made.

6. For some species or locations it may be desirable to record other possible variables. For instance, in eastern hemlock, note should be made of whether or not the sample occurred on a site with high incidence of shake. Where both old- and second-growth even-aged stands of intolerant species are sold the two classes may be separated in field measurements and a set of tables prepared for each.

Volume Table Preparation

If the field data fits reasonably close to available local gross volume tables, they may be used as a basis for calculating net tables as described under that subheading below. If not, or if local tables are not available, they must first be prepared. Systems for doing this are available in standard texts. Below, under the heading *Gross Tables*, a simple system not before published, is described. It gives a close uniform fit.

Gross tables.—Field measurements are sorted as follows:

1. Species. Where examination of the data shows similar form, volume and defect, data for species of rare occurrence may be combined with that of the appropriate common species.

2. Height classes. Half log height classes, including trim allowance, are usually used.

3. Diameter classes. Half-inch classes should first be sorted and combined, then precise averages calculated for d.b.h. and volume (tenth inch and tenth board-foot). If these do not curve rather

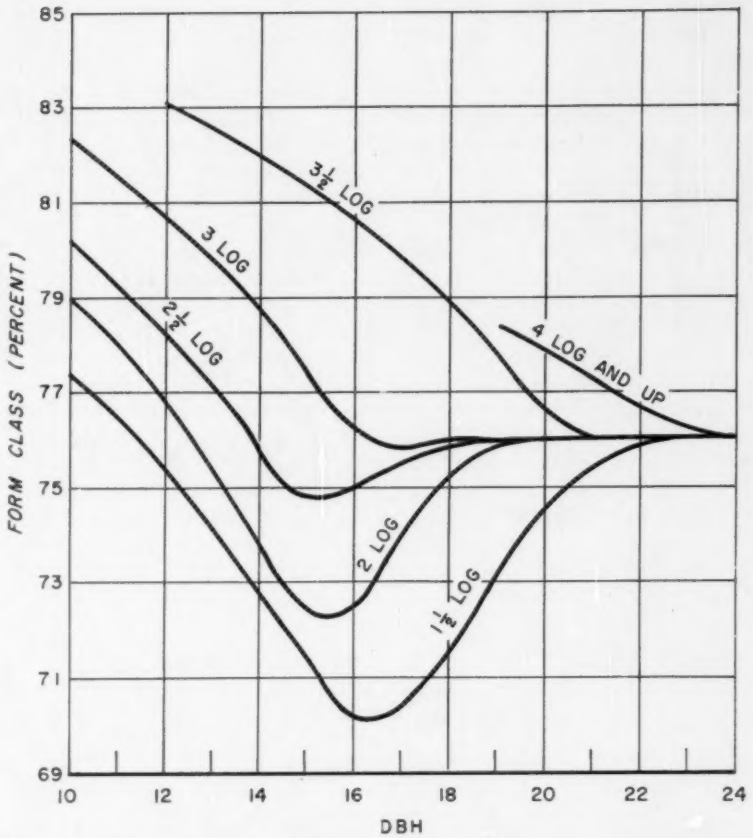

FIG. 2.—Form class curves, loblolly pine, northern Alabama.

TABLE 3.—FORM CLASS (PERCENT), BY NUMBER OF 16-FOOT LOGS, FOR LOBLOLLY PINE IN NORTHERN ALABAMA

T = tentative form class[1]
F = final form class[2]

	1 & 1½		2		2½		3		3½		4 & up	
D.b.h.	T	F	T	F	T	F	T	F	T	F	T	F
8		79.1										
9		78.3		79.7		80.9						
10	77.5	77.5	81.0	79.0	80.0	80.2		82.4				
11	76.5	76.5	77.5	78.1	79.0	79.3		81.6				
12	75.5	75.5	77.0	76.8	78.0	78.3	82.9	80.7		83.2		83.2
13	73.7	74.1	76.0	75.4	77.5	77.2	79.5	79.8		82.6		82.6
14	73.0	72.8	72.8	73.8	78.0	75.9	77.5	78.8	81.7	81.9	81.7	81.9
15	71.5	71.5	71.3	72.5	74.8	74.8	78.3	77.4	81.5	81.4	80.4	81.4
16	70.2	70.2	72.4	72.4	75.0	75.0	77.9	76.2	80.7	80.7	79.5	80.7
17	70.4	70.4	73.6	74.0	75.4	75.4	75.8	75.8	79.9	79.8	79.1	79.8
18	71.6	71.6	75.8	75.2	75.9	75.9	75.0	76.0	79.3	79.0	79.0	79.0
19	73.8	73.1		75.9	76.1	76.0	76.6		77.9	77.8	81.0	78.4
20	75.8	74.5		76.0	75.9		76.0		77.0	76.7	80.2	77.9
21		75.4					75.9		76.0	76.0	78.0	77.3
22		75.8					77.0		74.8		76.2	76.7
23		76.0					73.8		75.6			76.2
24							79.0					76.0

[1]Empirical form class of tentative gross volumes interpolated in Mesavage-Girard F.C. Tables.

[2]Curved from tentative form class (Figure 2). In each height class curves run at or close to F.C. 76 above the point where it is reached.

smoothly some combinations may be made. This is usually desirable near the limits of the observations.

Tentative gross volume curves are drawn from these data. By height classes average volumes are plotted over average d.b.h. The dotted curves in Figure 1 are an example. Except as shown by dotted lines the first and final curves coincided.

From the curves a tenative gross volume table is prepared. It should be by 1-inch d.b.h. classes and the selected height classes. Table 2 illustrates this step.

By interpolation in a set of form class tables an empirical form class represented by each volume in the tentative table is determined (to a tenth percent) and recorded. This is illustrated in Table 3. While this is a reversal of the dependent and independent variables, the procedure has been found to be simple and practical. Actual form classes may be measured and used but this introduces the probability of additional bias and is an unnecessary field expense.

Using the tentative form class table, a curve of form classes over 1-inch d.b.h. classes is drawn for each height class. A sample of these curves is shown in Figure 2. This illustrates the fallacy of attempting to fit net tree volumes to a single form class table. It will be noted that within a single pine species, form class increases appreciably with merchantable height, at the same diameter. Also it will usually be found that in the taller timber, the form class will curve downward as diameter increases. In shorter timber (particularly conifers) it is more likely to curve sharply downward with increasing diameter than reverse and curve sharply upward. In hardwoods the form class data may indicate the desirability of curving without height classification.

A final form class tabulation, as shown in Table 3, is read from the smoothed form class curves. By interpolation in the form class tables this tabulation is converted to a gross volume table.

A check of each gross table may be made by running the original gross scale through it. Scaled and table volumes should be uniformly close for sums of volumes in each height class and in each diameter class. The difference in total gross

Dist.____ W.C._____ Compt._____ Pmf. Unit._____ **YELLOW POPLAR**

Scalers_____ Dates_____ Species_____

NUMBER OF 16' LOGS

DBH		1/2	1	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5
30	S		40	55	70	84	97	107	116	127	138
	D		32	43	55	64	74	81	88	96	104
32	S		48	67	86	102	119	132	145	157	170
	D		39	52	66	78	90	100	110	119	128
34	S		57	78	100	120	140	155	171	186	201
	D		44	60	77	91	106	117	129	140	151
36	S		64	89	114	137	160	178	196	214	231
	D		50	68	87	104	121	134	147	160	173
	S										
	D										
	S										
	D										
	S										
	D										
	S										
	D										

CHECK TREES

No.	DBH	Ht.	Gr.	No.	DBH	Ht.	Gr.	No.	DBH	Ht.	Gr.	No.	DBH	Ht.	Gr.
1				17				33				49			
2				18				34				50			
3				19				35				51			
4				20				36				52			
5				21				37				53			
6				22				38				54			
7				23				39				55			
8				24				40				56			
9				25				41				57			
10				26				42				58			
11				27				43				59			
12				28				44				60			
13				29				45				61			
14				30				46				62			
15				31				47				63			
16				32				48				64			

No. Trees_____ No. Logs_____ Total Net Volume_____

Computed by: _____ (Initials) _____ (Date)

Audited by: _____ _____

Number of 16' Logs

DBH		1/2	1	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5
10	S		3	4	5	6	6				
	D		3	4	5	5	6				
12	S		5	6	7	8	9	10	10		
	D		4	6	7	8	9	9	10		
14	S		7	9	11	13	14	15	16		
	D		6	8	10	12	13	15	15		
16	S		10	12	15	18	21	23	24		
	D		9	12	14	17	19	20	21		
18	S		12	16	21	24	28	31	33		
	D		12	15	18	21	24	26	27		
20	S		16	21	27	31	36	39	42	45	48
	D		14	19	23	26	29	32	34	36	38
22	S		19	26	33	39	45	49	53	57	61
	D		17	23	27	32	36	39	42	45	47
24	S		23	32	40	47	55	60	65	70	75
	D		20	26	33	38	43	47	51	54	58
26	S		27	38	48	57	65	72	78	85	91
	D		23	31	38	44	51	56	61	65	70
28	S		33	46	58	69	80	88	96	104	112
	D		28	37	46	54	62	68	74	79	85

FIG. 3—Scale book sheet for 100 percent tree measurement.

scale should be less than 1 percent. If it exceeds 1 percent an error in curving or calculation is indicated.

Net tables.—After separation of the original data into Apparently Sound and Obviously Defective classes a least squares formula (usually $Y = a + bx$, although curvilinear correction is quite feasible) is solved for each. Observed net volume data are set up as Y and corresponding gross table volumes as X. Finished net volume tables are shown in Table 4.

To check net volume tables each height class may be curved, volume over d.b.h., as is illustrated by the solid lines in Figure 1. If any point falls off a smooth curve it will indicate an error. Occasionally the "a" value will be so high that the lower ends of the curves should be adjusted slightly downward. To illustrate the relation of net to gross volumes over a wide range of species, calculated values of "a" and "b" are shown in the last two columns in Table 1.

The final check of these tables comes with use. Sales or logging units may be tree measured, then log scaled (including any merchantable material that may have been left on the ground) after cutting. Over the past 10 years many such checks have shown that these tables, properly used, are as accurate as log scaling.

For instance, the two most severe tests made under the relatively complex Southern Appalachian conditions gave the following results: (1) Maximum variation was found on a check of 1,400 MBF of high-altitude timber averaging 752 net board-feet per tree. The trees measured 5.1 percent less than the logs. Since 85 percent of the volume was in highly defective low-grade and low-value hemlock, silverbell, beech, and buckeye, this was considered satisfactory. (2) Under more typical conditions 1,700 MBF measured 3.7 percent more than the derived logs. This test included a mixture of 17 species of conifers and hardwoods averaging 187 net board-feet per tree. The system is almost certain to be more accurate and consistent than log scaling by inexperienced men or under difficult conditions, such as in rafts, truck loads, or decks.

100 Percent Tree Measurement

All trees are measured as they are marked where: (1) justified by large size or high value; (2) required because of small species populations; (3) required because of high incidence or proportion of cull; or (4) total volume is in a small number of trees, regardless of other factors. In highly defective old growth, minimum volumes for tree measurement should be established to avoid the possibility of unacceptable percentagewise error. Diameters are measured (estimated when there are deformities at breast height). Heights may be estimated with measured checks in short timber. When a tree forks it is measured as one tree if the fork is above the length of a minimum log. Merchantable height is that of the longest fork. Trees forking below a minimum log length are tallied as two trees. Since utilization will sometimes vary with markets the merchantable height acceptable to good operators may change from time to time, especially in hardwoods. Ex-

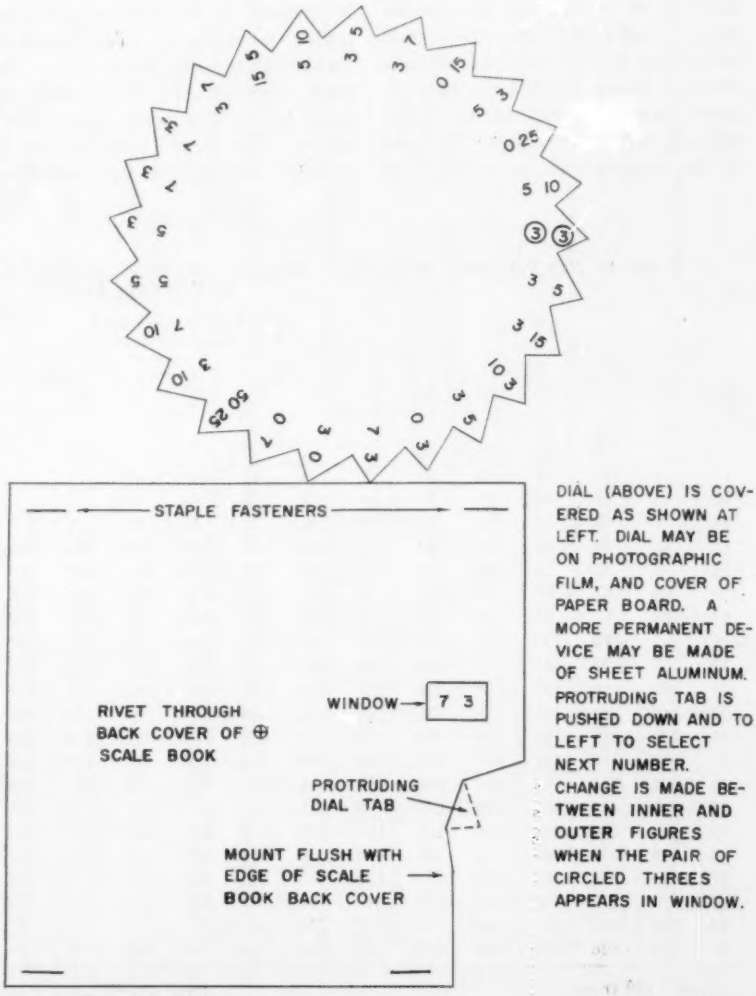
STAPLE FASTENERS
RIVET THROUGH BACK COVER OF SCALE BOOK
WINDOW
7 3
PROTRUDING DIAL TAB
MOUNT FLUSH WITH EDGE OF SCALE BOOK BACK COVER
DIAL (ABOVE) IS COVERED AS SHOWN AT LEFT. DIAL MAY BE ON PHOTOGRAPHIC FILM, AND COVER OF PAPER BOARD. A MORE PERMANENT DEVICE MAY BE MADE OF SHEET ALUMINUM. PROTRUDING TAB IS PUSHED DOWN AND TO LEFT TO SELECT NEXT NUMBER. CHANGE IS MADE BETWEEN INNER AND OUTER FIGURES WHEN THE PAIR OF CIRCLED THREES APPEARS IN WINDOW.

FIG. 4.—Sampling device.

perience has shown that adjusting height measurements to such small changes will not significantly affect volume accuracy. The marker must not under any circumstances make allowance or adjustment for cull.

Marked trees are dot-tallied, on a form such as Figure 3, by species, d.b.h., height, and defect class. Where all trees are so tallied the job may be simplified by broadening the diameter groupings, usually to 2-inch classes, and rounding table volumes to Decimal C. Numerals and symbols may be placed on check trees with a marking paint gun to identify the marker and his tree classification, if a check is desired.

Sample Tree Measurement

Where the number of trees to be marked in a species or species group is sufficiently large to permit measuring of one tree out of each three or more, much time and expense can be saved at an insignificant loss of accuracy. The size of the sample can be reduced by stratification of the total tree tally. Minimum sampling designs for southern conditions are given in Table 5. With adequate checking they should be useful elsewhere. In southern pine, stratification of total tally by 6-inch d.b.h. classes has been found to be efficient. Table 6 is taken from Grosenbaugh's designs and fitted to this diameter classification and to the sampling device illustrated in Figure 4. There has been no experience with sampling hardwoods. It is likely that similar procedures would give comparable results for even-aged hardwoods such as aspen or second growth yellow poplar.

One of several suitable systems for recording both total tree tally (by 6-inch d.b.h. classes) and measurements of sample trees is shown in Figure 5. Each tree must be tallied as marked. The sampler (which is usually fastened to the back cover of the scale book or tally holder) is then turned one notch. The tree is taken for a sample only when the sampling interval number shows up. This gives a random sample from each 50-tree unit marked. For gaining confidence of markers and purchasers it may be noted that 1½ percent standard error indicates a probable error, due to sampling, of only about 1 percent.

The sample tally sheet (Fig. 5) provides for a summary which is made by counting dots and dot clusters and by cumulative multiplication of sample volumes. This summary, for each species, is entered on a work sheet, one form of which is shown as Figure 6. For each diameter and defect class the average volume of the sample trees is calculated and then extended to the total number of trees marked. Where calculations are by logging units each successive unit is added to those previously completed and calculations made of totals to date. Thus, possible error due to sampling is progressively reduced until the calculated accuracy is achieved when all of the units are completed. In the example used all trees 21

TABLE 4.—NET VOLUME IN BOARD-FEET (SCRIBNER LOG RULE), BY NUMBER OF 16-FOOT LOGS FOR LOBLOLLY PINE IN NORTHERN ALABAMA

S = Apparently sound
D = Obviously defective

D.b.h.	1		1½		2		2½		3		3½		4		4½		5	
	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D
8	15	3	18	6														
9	21	9	27	15	36	24	44	32										
10	27	15	35	23	45	33	53	41	64	51								
11	35	23	45	33	60	48	69	56	84	71								
12	42	30	55	43	70	57	86	73	104	91	124	111	132	119				
13	51	39	66	53	85	72	104	91	129	116	154	141	163	150				
14	58	46	75	62	98	85	120	107	152	139	182	169	195	181				
15	66	53	87	74	111	98	140	127	174	161	217	203	234	220				
16	75	62	98	85	130	117	165	152	199	185	252	238	273	259				
17	87	74	115	102	161	148	197	183	229	215	285	271	309	295				
18	103	90	137	124	192	178	231	217	265	251	318	303	345	330				
19	120	107	163	150	225	211	264	250	303	289	350	335	388	373				
20	142	129	192	178	254	240	298	284	341	326	382	367	431	416	457	431	484	468
21	162	149	220	206	284	270	334	319	384	369	420	405	477	461	509	493	541	525
22	181	168	247	233	315	300	370	355	426	411	468	452	520	504	556	540	591	574
23	202	188	276	262	350	335	412	397	474	458	519	503	569	542	611	594	652	635
24	221	207	303	289	385	370	454	438	523	507	572	555	620	603	668	651	716	698
25	244	230	334	319	425	410	502	486	580	563	636	619	693	675	747	729	801	783
26	266	252	366	351	465	449	550	534	636	619	701	683	766	748	826	807	886	867
27	288	274	397	382	506	490	600	583	694	676	764	746	834	815	902	883	970	950
28	311	297	430	415	548	532	650	633	752	734	828	809	903	884	979	959	1055	1035
29	336	321	465	449	594	577	704	686	815	797	896	877	978	958	1062	1042	1147	1126
30	361	346	500	484	639	622	758	740	878	859	966	946	1054	1034	1146	1121	1239	1217

Basis: 330 trees.
DJM 1/29/48

TABLE 5.—MINIMUM SAMPLING DESIGNS FOR 1½ PERCENT STANDARD ERROR[1]

Strata used	Estimated total number of trees to be marked																				
	1M	1½M	2M	2½M	3M	4M	5M	6M	7M	8M	9M	10M	12M	14M	16M	18M	20M	25M	30M	35M	40M	Inf.
Pine, 2 inch groups (30% C.V.)																						
Optimum sampling number	290	320	340	350	360	370	380	380	380	390	390	390	390	390	390	390	400	400	400	400	400	400
Proportional sampling interval	3	4	5	7	8	10	12	15	17	20	22	25	30	35	40	45	60	60	70	85	100	.....
Pine, 4-inch groups or Hardwood 2-inch groups (35% C.V.)																						
Optimum sampling number	360	400	430	450	470	480	490	500	510	520	520	520	530	530	530	530	540	540	540	540	540	545
Proportional sampling interval	2	3	4	5	6	8	10	11	13	15	17	19	22	25	30	33	35	45	55	65	70	.....
Pine, 6-inch groups or Hardwood 4-inch groups (40% C.V.)																						
Optimum sampling number	420	490	530	560	580	610	630	640	650	660	660	670	680	680	690	690	690	700	700	700	700	712
Proportional sampling interval	2	3	3	4	5	6	8	9	10	12	13	15	17	20	23	25	30	35	40	50	55	.....
Hardwood, 6-inch groups (50% C.V.)																						
Optimum sampling number	530	640	720	770	820	880	910	940	960	980	990	1000	1020	1030	1040	1050	1060	1070	1080	1080	1090	1112
Proportional sampling interval	All	2	2	3	3	4	5	6	7	8	9	10	11	13	15	17	18	23	27	32	36	.....

Table is excerpt from unpublished memorandum of L. R. Grosenbaugh dated June 10, 1948 (RS-SS MENSURATION, General, Sample Tree Measurement). Coefficients of variation within strata were based on analysis of scale books in various National Forests in the South (pine from Texas, Alabama, Ouachita, and Mississippi National Forests, hardwood from Mississippi National Forests). Statistical basis for table construction is described in Grosenbaugh, L. R. 1952, Shortcuts for cruisers and scalers. United States Forest Service Southern Forest Experiment Station Occasional Paper 126, 24 pp. (especially pages 21-24) from which tables for different sampling errors can also be constructed. It can easily be shown that when strata have identical within-strata coefficients of variation (C), the total number of samples needed for a percent error (A) in an infinite population with optimum allocation is $N_{\infty} = \left(\frac{C}{A}\right)^2$. A conservative but reasonably close correction for finite population of size (M) changes this to $\frac{1}{\frac{1}{N_{\infty}} + \frac{1}{M}}$. Theory behind this and other aspects of stratified sampling is discussed in Cochran, W. G. 1953 Sampling techniques. John Wiley and Sons, New York City. 330 pp. (especially pages 87-88).

[1]Basic formulae (identities):

$$\text{Optimum sampling number needed} = \frac{(\text{Coefficient of variation})^2}{.000225 + \frac{(\text{Coefficient of variation})^2}{\text{Estimated total number of trees}}}$$

$$\text{Proportional sampling interval} = \frac{\text{Estimated total number of trees}}{\text{Optimum sampling number needed at infinity}} + 1$$

Estimated total number of trees = (Proportional sampling interval − 1) (Optimum sampling number needed at infinity)

Table assumes identical Coefficient of Variation throughout any given stratification, and increases proportional sampling slightly over optimum to allow for fact that it is less efficient. Coefficients of Variation used were based on analysis of pine scale books on Texas, Alabama, Ouachita, and Mississippi National Forests, and analysis of hardwood scale books on Mississippi National Forest.

Prepared by Grosenbaugh, Lewis R., Southern Forest and Range Experiment Station, Forest Service, U.S.D.A., Unpublished.

TABLE 6.—SAMPLE INTERVAL FOR TREE POPULATIONS STRATIFIED BY 6-INCH DIAMETER CLASSES[1]

Minimum estimated population		
Conifer	Hardwood	Sample one tree out of—
1,500	2,500	3
3,000	5,000	5
4,400	7,000	7
6,500	10,000	10
12,200	16,000	15
17,600	27,500	25
36,000	56,000	50

[1]Adapted from Grosenbaugh's minimum sampling designs for 1½ percent standard error (Table 5) for use with sampling device (Figure 4).

inches d.b.h. and over are measured because of the small number of this size. In larger timber this size limit could be raised. One-inch d.b.h. classes are used. Source of net volume figures is the same as described for 100 percent tree measurement. The scale sheet illustrated in Figure 5 could be improved by printing species and net volumes on it. It could also be revised to permit entry of grading information.

Other Cost and Control Considerations

Scale audit.—Because of the small amount of calculation required per unit of volume, it is practicable to make complete audits of sample tree measurement records. Records for 100 percent tree measurement may be sample audited, although complete audit is less expensive than sample audit of log scale books. Complete audit may be desirable for high-value stumpage.

Check scale.—Where check scaling is required this system permits the check prior to sale (or release of a logging unit for cutting). Thus, subsequent volume adjustments are held to those necessary because of additional timber removed in sale area development or because of logging or other damage. In practice this material is often scaled (log or tree) against a small deposit held for the purpose.

Appraisal information.—Usually information on size and quality is necessary for accurate appraisal. It will be noted (Figs. 3 and 5) that the scale sheets will permit easy determination of volumes of average trees or logs. Also, they do or could show tree or log grades.

Type of sale.—Where timber is marked, greatest savings in seller-purchaser costs and possible disagreements are probably possible through lump sum sale of stumpage. This is practical where growth during the operation will be negligible because of (1) short term of contract, or (2) a practical balance between growth and mortality, as sometimes occurs in mature stands. For other conditions sale areas may be divided into logging units. Each unit is marked and measured as convenient, then released for cutting as a series of lump sum transactions.

Timber cruising.—Where volume estimates are required prior to sale or operation, either of these tree measurement systems may be used to determine the entire vol-

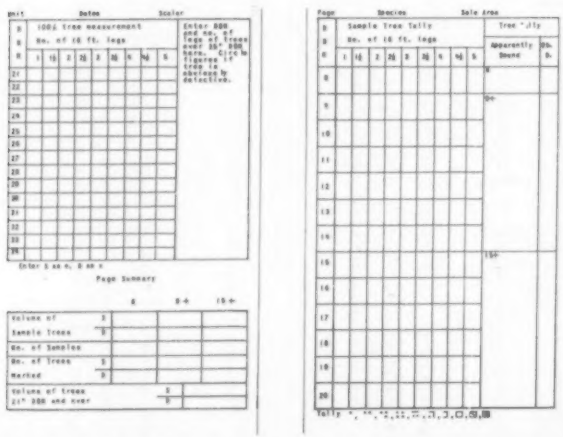

FIG. 5.—(Above) Scale book sheet for sample tree measurement.
FIG. 6.—(Right) Calculation sheet for sample tree measurement.

Working Circle_____ Sale Area_____

Compt. No._____ Summary through Logging Unit No._____

Species_____

	8" DBH & Less			9" - 14" DBH			15" - 20" DBH		
	Brought Forward	This Unit	Total	Brought Forward	This Unit	Total	Brought Forward	This Unit	Total
Volume of Sample Trees S									
Volume of Sample Trees D									
No. of Samples									
Volume of Avg. Sample S									
Volume of Avg. Sample D									
No. of Trees Marked S									
No. of Trees Marked D									
Total Volume S									
Total Volume D									

Total Volume 20" & Less DBH, SOUND & DEFECTIVE

Volume of Trees 21" + DBH, brought Forward, This Unit, and Total S

D

Total Volume of Species

Vol. Previously Reported

Volume of this Report

Summarized by_____ Date_____

Audited by_____ Date_____

In subsequent summaries "Total" of previous summary is "Brought Forward" from Unit No. _____

ume in advance thus eliminating the cost of timber cruising. In sales or operations of such size that cruise of unit areas not marked in advance is necessary, use of the net tables will improve cruised volume accuracy. They are also useful in general inventory work, such as for timber management planning purposes.

Summary

Systems of tree measurement and sample tree measurement are presented that are less expensive, yet more accurate than most other methods in common use. They have stood the trial of 10 years' application over wide areas and many species in the Southeastern United States. There is no technical reason that they cannot be used, or adapted for use, in any timber where markers can see and measure distances to merchantable tops.

Color Standardization for Foliage Description in Forestry

Lawrence S. Hamilton

IT IS ESTIMATED that man can distinguish as many as 2 million colors under good visual color-matching conditions, and perhaps as many as 8 million under the best instrumental conditions (*6*). The color of a natural object depends not only on the pigment of the surface, but on:

1. The illumination (amount and quality of light).
2. The surround or background (tends to throw a complementary hue or brightness).
3. The eye of the observer (inherited peculiarities of sensitivity, and the immediately preceding stimulation).

When, on top of all this variation we add the problem of describing a color to another person (thereby introducing the factors of memory, previous training and vocabulary), it is even doubtful that the commonly-used word-color designations mean exactly the same thing to any two persons. In any science using color designations, some standards must be agreed upon so that intelligent and accurate communication is possible.

The Need for Standards

Color standards are assuredly needed for work in forestry. Those engaged in forest soils work use the standardized color classification for soils which has been adopted by soil scientists in the United States (*7*). Color standardization, however, has not carried over into other branches of forestry—yet characteristic color is a necessary descriptive tool throughout the range of forestry endeavor, from dendrology and wood technology to forest genetics and forest pathology. The writer is particularly concerned with the impreciseness of color designations for tree foliage.

That there is little agreement among foresters is suggested by a recent test at a Society of American Foresters meeting. Under artificial light, 35 men were asked to name the color of a specimen sugar maple leaf. The replies could be classified into 12 distinct color descriptions including such different designations as: dark green, pea green, olive, gray green, yellowish green and pale green with a yellowish cast.

Interest in forest fertilization is increasing rapidly in this country, and corresponding work is being carried out in nutrient deficiencies in trees. It is rather strange that the soils people who are carrying out these investigations, in spite of their preciseness in color classification of soils, lapse into the inexact language of the layman's color vocabulary when they describe deficiency symptoms. A few typical samples of such writing follow: "In iron deficiency the older foliage remains a good green color, whereas in sulfur deficiency the older foliage is paler than normal, although not so yellowish as the younger portions of the plant" (*2*); "The first year needles become clear golden yellow. . . . The zone of clear yellow color together with a broad yellow-green transition. . . ." (*8*). Perhaps this is not to be wondered at, for in agriculture one also finds the same type of thing. One of the notable works on nutrient deficiencies, Wallace's *The Diagnosis of Mineral Deficiencies in Plants by Visual Symptoms*, uses such color descriptions as: high yellow, bluish green, dark green, yellow tinting, cream—without referencing these to any standard (*9*).

Studies in forest genetics often employ foliage color differences as an important characteristic in differentiating races. The pronounced winter yellowing of needles of certain races of Scotch pine have focused particular attention on the winter foliage color of this species. Yet reports issued to date on this subject have used color designations which may mean different things to different observers. One report for example, classifies sources of Scotch pine according to the following seven color classes: pronounced blue-green, bluish-green, slightly blue-green, deep dark green, dull yellowish-green, yellow-green (or rarely blue) often with gold tips to the needles, and golden (*1*).

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Color Standard Systems

Standards are available which *could* and *should* be used by workers concerned with foliage color. The writer urges the adoption of standards, and suggests that for foliage color the Munsell System standards and designations be used. Munsell color charts have been published for plant tissues (*3*). This permits the describing and analyzing of color in terms of hue, lightness (value), and saturation (chroma) under daylight conditions. Figure 1 shows samples having the same hue (designated as greenish Green-Yellow or 7.5 GY, a characteristic hue for the needles of many of the so-called "blue-green" varieties of Scotch pine). The vertical "value" notation indicates approximately equal lightness differences in relation to a neutral gray scale from a theoretical pure black to a theoretical pure white on a scale from 0 to 10. The horizontal series, "chroma," indicate equal saturation differences from 0 for a neutral gray of a particular lightness value, to 10 or further depending on the saturation of that color. The lack of standard color "chips" for all positions on the scales reflects the limitations of the pigments used. By matching a foliage specimen with the color chip which it most closely resembles, a numerical notation can be given (for example 7.5 GY 6/8) which is fairly precise, and meaningful to other investigators. Whenever a finer division is needed, interpolations may be made, using masks to screen off surrounding chips, involving half hue steps and tenths of value and chroma steps (*5*).

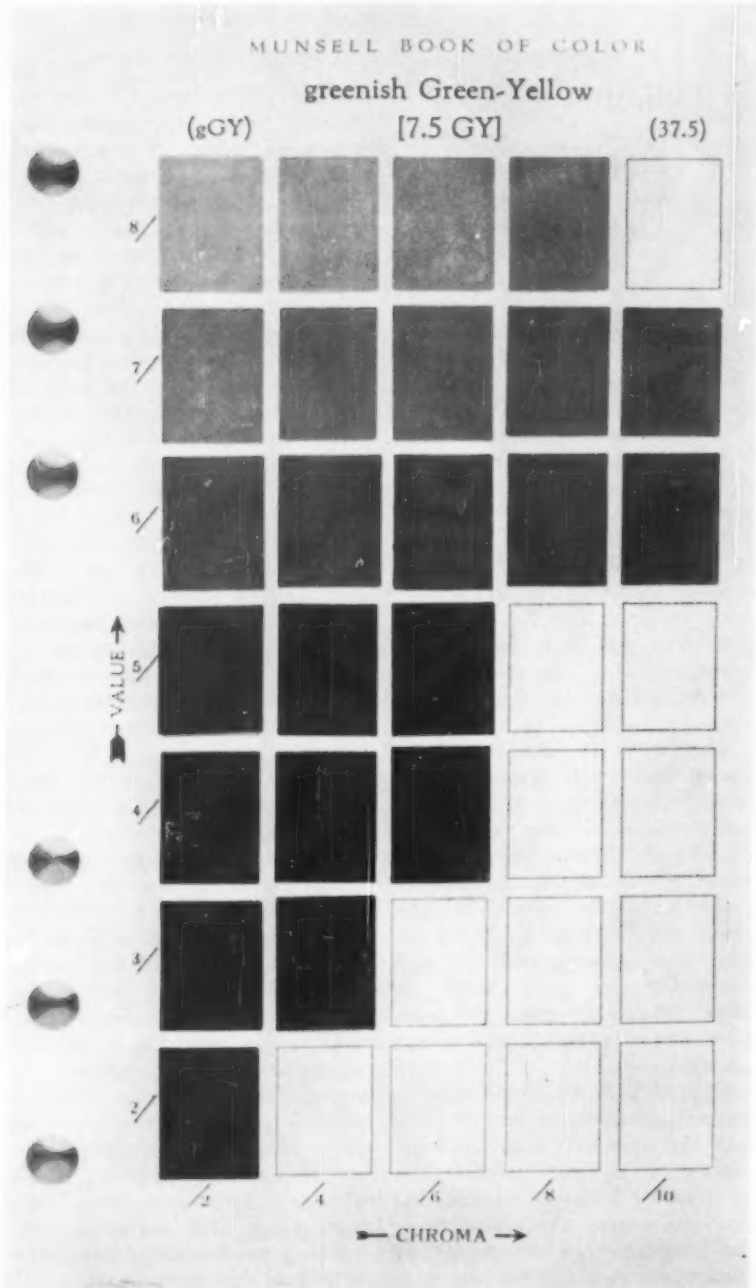

FIG. 1.—Illustration of samples having the same greenish-yellow hue.

If descriptive color names are desired rather than numerical Munsell notations, one of the standand color dictionaries such as the *Ridgway Color Dictionary*, the *Maerz and Paul Dictionary of Color* or the systematic color names developed by the Inter-Society Color Council and the National Bureau of Standards may be used. The writer suggests that in forestry, the latter (I.S.C.C.-N.B.S.) designation be used. This provides for slightly over 300 designations, corresponding as closely as possible to actual usage and keyed to the Munsell system (e.g., 9 YR 7/8 is designated as "moderate yellowish orange"). Where precision is not important, and comprehensibility to laymen is desired, such a descriptive name would seem justified, but should be referenced to the I.S.C.C.-N.B.S. system or the appropriate Munsell notation.

Precautions

Color perception weaknesses are extremely common, much more so among men than women. It is estimated that 4 to 10 percent of the

male population is color-anomalous, and many of these are "color-blind" or partially "color-blind" (*4*). At a recent meeting of a Christmas tree growers' association (a group very conscious of foliage color), a testing of 47 members showed that 29 of them had some color perception weaknesses.[1] Even among the color-capable there is a great variation in perception of color differences. It is important therefore, before undertaking investigations which involve the precise identification of color, to have one's color vision tested. It is also important to learn something about the nature of color. The illumination (preferably daylight) and the background (preferably medium neutral gray) should be recorded or systematized.

[1]Scoring on 13 pseudo-isochromatic test plates was as follows for the 47 persons tested: all correct—18, one wrong—13, two wrong—10, three wrong—3, more than three wrong—3.

Recommendation

For accurate observation to be translatable and usable, it must be recorded or described in meaningful and precise terms. To this end it is recommended that standard color references be more widely employed, and that a single standard such as the Munsell system (coupled with the I.S.C.C.-N.B.S. names where needed) be adopted by the forestry profession, and that observation conditions be agreed upon.

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New Pay Scales for Pennsylvania Foresters

Maurice K. Goddard, secretary of the Pennsylvania Department of Forests and Waters, reports that his department has taken another forward step in continuing its efforts to meet the competing demand for foresters.

On November 9, 1959 the Commonwealth's Executive Board approved upward revisions in the compensation for Forester I through Forester V classes.

Prior to the revisions, the pay ranges were:

Class	Minimum	Maximum
Forester I	$4,329	$5,529
Forester II	5,007	6,390
Forester III	6,090	7,772
Forester IV	7,055	9,011
Forester V	8,580	10,954

Under the Executive Board action, the new compensation plan was initiated on November 9 as follows:

Forester I, $4,773 to $6,090. This is the beginning level for professional forestry work, requiring graduation from a forestry school accredited by the Council of the Society of American Foresters.

Forester II, $5,268 to $6,716. This is the category requiring "supervisory and technical forestry work," and is open to graduates of accredited forestry schools with at least one year of professional experience.

Forester III, $6,390 to $8,163. This is professional forestry work serving as "assistant to the director of a state forest district, directing a major phase of a forestry program in the field, or performing equally responsible work in the central office." This classification is open to graduates of accredited forest schools with four years of progressively responsible experience.

Forester IV, $7,407 to $9,454. Consists of administrative and professional forestry work in "directing the forestry program in a state forest district or as assistant to the director of a major phase of the statewide forestry program." In addition to graduation from an accredited forestry school, six years of progressively responsible experience is required.

Forester V, $9,011 to $11,501. This classification is confined to central office top level supervisors and requires "the overall direction of a major phase of the forestry program on a statewide basis." Eight years of progressively responsible experience, in addition to graduation from an approved forestry school, constitutes the requirement for qualifying in this forester category.

Secretary Goddard, in commenting on the Executive Board action, stated that "in revising the pay scale for the that no Compensation Plan can remain static if it is to be effective." He said that, "in revising the pay scale for the Forester I class from what was established in 1956, the Department acknowledged that, to attract prospective forestry graduates, it must provide a salary somewhat comparable to that offered by the U. S. Forest Service, industry and other states."

As the result of a Forester I Civil Service examination given earlier this year, the department employed four of the top five people on the eligible register. Goddard said: "If Pennsylvania is to continue recruiting young people of a high caliber and maintain a steady influx of foresters, we must pay a salary which will attract and hold them in the State service." The secretary further pointed out that the revisions in the compensation for the Forester II through Forester V classes have the advantage of enabling the department to retain its existing personnel because of the higher salary limits to which those in each class can advance by meritorious salary increases.

Economic Models for Thinning and Reproducing Even-Aged Stands

John Fedkiw and James G. Yoho

AMERICAN FORESTRY is being widely accepted, and increasingly so, as a business enterprise for profit. Its dominant forestry characteristic is even-aged stand management with emphasis on early and frequent commercial thinnings. In fact, much of the profitability in modern even-aged management can be attributed to the possibility of early and frequent commercial thinnings.

Although even-aged management, along with American forestry in general, is being regarded as a business matter, thinning practices are still seemingly dominated by silvicultural considerations which often are associated with basal area or spacing guides and accompanying preferences for heavy, light, or some intermediate level of thinning. These guides are essentially physical or biological rules for thinning and do not appear to take into account the economic interests of the forest owner. For that matter they seem to suggest that the owner does not have any alternatives—that the forest is the determinant. But this is an exaggerated interpretation.

The application of physical or biological thinning guides do have economic consequences for the forest owner. And, for the most part, such consequences tend to be favorably accepted by the owners. What basis does the owner or the forester have to do otherwise? How would the forester answer the question: Why is this particular spacing or basal area economically the best thinning alternative for many different forest owners or even any single forest owner? Not infrequently the answer received for the economic aspects of this question is couched in terms referring to "experience" or "good judgment" or both. But what do these terms mean?

These questions are not raised to criticize the use of such guides nor to suggest that foresters ordinarily do not thin stands according to the best interests of forest owners. The question is raised, however, to suggest that there is a clear need to provide an objective economic basis for selecting the optimum method, intensity and frequency of thinning. The profession today clearly recognizes that forestry is a business, and therefore, that decisions with respect to thinnings and regeneration need to be based on objective economic criteria applied within the ranges of biological and engineering alternatives applicable to each particular forest and forest owner situation. It is with this thought in mind that the following theoretical economic models are presented for the consideration of the profession as guides to thinning and reproduction of established commercially operable even-aged stands.

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The Alternative Rate of Return Concept

The growing stock of an even-aged stand, together with the soil and space it occupies, constitutes a capital asset or investment to the owner much like a bond or share of common stock. In our present inflation-ridden economy, it is probably better to compare land and growing stock to common stock which tends to retain its purchasing power during periods of decreasing value of money. The desirability of holding a capital asset or investment, according to the alternative rate of return concept, is determined by the rate of return that investment is earning in comparison to other investment alternatives.[1] Thus, if a particular asset is earning less than its sale or liquidation value might earn in another investment, it is ordinarily better to sell such an asset and reinvest the proceeds in the most attractive alternative. Conversely, if the asset is earning a higher rate than the owner can realize in his next best investment opportunity, he is better off to retain that asset and its earning power. The criterion for the decision to liquidate a particular asset, investment, or tree, is the rate of return provided by the owner's best alternative investment opportunity. This rate is commonly referred to as the alternative rate of return of the owner. It may be noted that this is essentially the same proposition as that underlying the financial maturity principle as applied to individual trees.[2]

The First Thinning

Thinning of even-aged stands is accomplished by harvesting individual trees and leaving others. To do so with thorough economic rigor requires that each tree be considered a capital asset which can be liquidated for consumption purposes or for reinvestment in a more remunerative alternative. In making a thinning with economic considerations in mind, the forester's function is to appraise the potential earning capacity of the various investments represented by the trees in the stand and then decide

[1] Such comparisons should be made after differences in risk, taxes, and cost of reinvestment have been taken into account.

[2] Fedkiw, John, and James G. Yoho. Financial maturity—what's it good for? Jour. Forestry 54: 587-590. 1956.

which assets (trees) do not meet the owner's standards of productivity and which others can be expected to continue to earn a return equivalent to or greater than the owner's alternative rate.

In even-aged stands it can be demonstrated that trees are earning different rates of return on their conversion surplus value.[3] It is generally recognized that as the density of a stand increases the average rate of diameter growth tends to decline, more so for intermediate and codominant trees than for dominant trees. Usually, as diameter growth rate declines or remains constant while the size of a tree increases, its rate of volume and value increment declines likewise. It is in this general way that some trees in a stand become financially mature and ready for thinning or removal as sub-productive assets. Table 1 illustrates this general pattern of stand and tree behavior. The data are for a ¼-acre permanent sample plot of loblolly pine 19 years old at the time of the first thinning in 1934. Value growth percents are the performance of leave trees. They are based on cubic foot growth and conversion surplus corresponding approximately to stumpage sale value as pulpwood with no price differential for size or volume cut per acre. It can be reasonably presumed that the cut trees had generally lower expected value growth percents than the leave trees—theoretically, lower than some alternative rate of return. The poor performance of a few trees in the 1950-1955 period would suggest errors in judgment with respect to expected performance as pulpwood trees and imply that a heavier thinning may have been in order.[4]

A stand is ordinarily ready for its first commercial thinning as soon as the total volume or value of trees whose value growth rates have fallen below the owner's alternative rate has accumulated sufficiently to provide an economic logging operation at the going market prices for stumpage or delivered products. For pulpwood operations in the South and Northeast, the minimum cut per acre for commercial thinning is commonly considered to be about three to four cords.

The expected value growth rate after thinning is the correct economic guide for harvesting or leaving individual trees. If this guide could be applied precisely, the forester would always tend to retain on the soil the maximum value of growing stock which is still earning at or above the owner's alternative rate. Likewise, the owner would have the net cash value of the harvested trees for reinvestment elsewhere on his forest property or in another enterprise at the alternative rate. Observance of these guides tends to lead to the management of the owner's capital so as to obtain maximum earnings from all his resources in accordance with his alternative investment opportunities. No other economic rationale is justifiable for the practice of private forest management.

In determining the expected earning rate of an individual tree, the forester needs to keep in mind differences from tree to tree in the price per cubic foot of the several potentially marketable products, such as pulpwood, poles, and sawlogs. For example, a tree that is presently pulpwood size might be judged financially mature on the basis of its anticipated value growth rate if it is expected to remain marketable only as pulpwood. On the other hand, the same tree offering the same cubic foot volume growth expectation, may have an anticipated value growth rate well above the owner's alternative rate if it promises to become marketable as sawtimber at the next thinning.

The determination of earning rates for individual trees must also take into account the expected value growth beyond the next thinning. Therefore the value of some

TABLE 1.—DISTRIBUTION OF INDIVIDUAL VALUE GROWTH PERCENTS OF LEAVE TREES FOR ¼-ACRE PERMANENT SAMPLE PLOT OF LOBLOLLY PINE, 19 YEARS OLD AT TIME OF FIRST THINNING IN 1934

Value growth percent class	Period				
	1934-1940	1940-1945	1945-1950	1950-1955	1955[1]
	Number of leave trees per plot at beginning of period				
13.0	4				
12.0	8				
11.0	24				
10.0	33		1		
9.0	19	1	1		
8.0	11	1	6		
7.0	3	8	14		
6.0	2	19	13	4	
5.0		17	13	8	
4.0		13	2	17	
3.0		4	1	11	
2.0				1	
1.0				3	
Trees left after thinning	104	63	51	44	40
Average d.b.h.o.b. of leave trees (inches)	6.6	8.4	9.4	10.5	11.2
Cubic feet cut per acre	784	669	395	217	124
Cubic feet per acre after thinning[2]	1458	1983	2201	2770	3173
Value growth percent of stand	10.5	5.7	6.3	3.5	—

[1]Growth percents not calculated since 1960 data was not yet available.

[2]First three thinnings based on a basal area control of approximately 100 square feet per acre. In 1950 and 1955, thinning was based on basal area control of 110 square feet.

[3]"Conversion surplus is the residual value of the tree based on the price of the end product sold by the forest owner less the direct (variable) costs incurred in converting the tree into its end product." Fedkiw and Yoho, Ibid.

[4]Actually this plot was being managed for sawlogs and pulpwood. Five trees growing below 3 percent had been selected as crop trees and pruned in 1944. Actual diameter growth was less than 0.3" for each of these trees so that value growth percent as pruned sawlog trees would likewise be very low.

trees needs to be considered for several future thinning dates, especially if substantial quality improvement is anticipated. The individual future values should be related to present value using the relevant time period involved so as to determine the maximum expected rate of return on the present investment in the tree. If the maximum expected value growth rate so determined is above the owner's alternative rate, the tree would not be judged financially mature despite a growth rate below the alternative rate for some shorter intervening thinning period. In the observations of the authors such individual tree behavior is not common. It is most likely to be noted in that inteval between thinnings some one or two thinning periods before a tree passes into a product with a higher value per cubic foot of stumpage volume.

The Second and Subsequent Thinnings

Once a stand is thinned in accordance with the foregoing principles, each tree of the residual growing stock or residual capital will be earning at or above the alternative rate, providing the forester's judgment has been correct for every leave tree. However, as the density of the stand increases again, diameter growth rate will tend to fall off; first on a few trees, then gradually on a larger and larger number. The decreases in diameter growth rate need not be absolute. But because the volumes and values of individual trees in the stand are increasing, even those trees exhibiting uniform annual growth rings are ultimately bound to undergo a decrease in volume growth percent and, ordinarily, value growth percent. As a result of this process, the time will come again when the expected value growth rates of enough trees to constitute a commercially operable cut will fall below the alternative rate to indicate a second thinning for removal of unproductive assets.

The arrival or emergence of a commercially operable cut is neither an instantaneous nor absolute event. Trees become financially mature individually and their total harvestable volume will accumulate over time at different rates for different stands. The picture is further complicated by the fact that the requirements of a commercially operable cut vary with each owner, logging chance and market situation. Conceptually an owner should delay thinning until the loss in earnings per unit of time on the value of unproductive trees (measured by comparison with the opportunity of their value in an alternative investment) is equated with the additional earnings per unit of time which he may realize through a higher unit return. The higher unit return can arise from a higher unit price or lower unit cost due to the prospect of a larger sale volume.

After the second thinning, one can visualize the entire process described above being repeated periodically. Ultimately, however, the trees still remaining in the stand and growing at or above the alternative rate will constitute a volume or value too small to provide a commercially operable cut at a future date. At this time, or before, the economic optimum rotation or reproduction age will have been attained; the exact timing of the harvest or reproduction cut is discussed in detail hereinafter.

Figure 1 offers an idealized graphical illustration of the foregoing process for successive periodic thinnings. This model and the foregoing argument suggest that the basic guide to management of established even-aged stands is the value growth rate of individual residual trees plus the minimum per acre volume or value requirements for an economically operable cut. The model further implies that so long as the value growth percent of the stand as a whole exceeds the alternative rate, the stand is not financially mature. Moreover, so long as the expected value growth rate of the residual stand exceeds the alternative rate, the model implies the stand is not fully stocked. This indicates that the stand should be continued and likewise that the growing stock should be increased through ac-

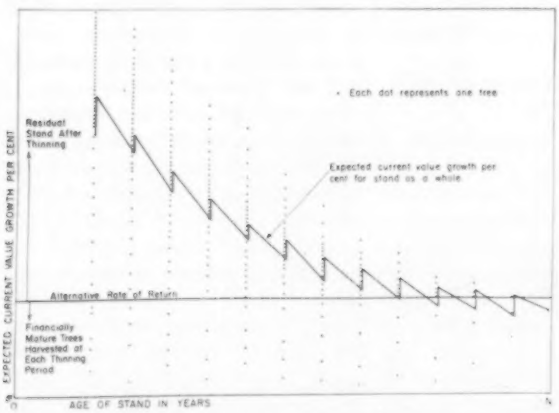
Each dot represents one tree
Residual Stand After Thinning
Expected current value growth per cent for stand as a whole
Alternative Rate of Return
Financially Mature Trees Harvested at Each Thinning Period
EXPECTED CURRENT VALUE GROWTH PER CENT
AGE OF STAND IN YEARS

FIG. 1.—Idealized model of the development of an even-aged stand showing distribution of individual trees by value growth percent at time of each thinning. The saw-toothed curve illustrates the trend of the value growth percent of the residual stand as a whole and demonstrates change in stand value growth percent as a result of each thinning.

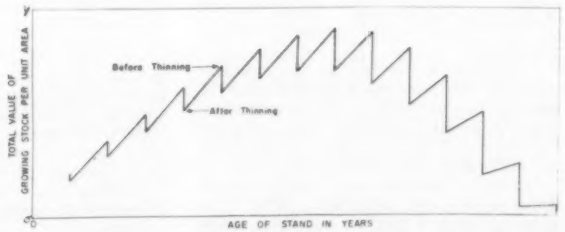

FIG. 2.—Idealized model illustrating the development of growing stock in an even-aged stand in terms of total value per unit area. This model can be looked upon as an idealized financial yield table corresponding to the idealized stand management model illustrated in Figure 1.

cumulation of the growth of residual trees. This follows since volume growth rates, and consequently value growth rates, of individual trees and the stand as a whole are a function of the density of stocking. Thus, whenever the stand growth percent exceeds the alternative rate, the model implies the stand is under-stocked from the economic standpoint. This idea applies so long as the value of financially mature trees removed at each thinning is less than the expected value growth of the residual trees in the period to the next thinning, assuming thinnings are equally spaced. If the model indicates that the value of the thinning exceeds the value growth for the next period, the stand is over stocked from an economic point of view and stocking should be reduced in order to maintain the value growth rate of the residual trees and stand at or above the alternative rate. This process of increasing the value of growing stock per unit area and then decreasing it is illustrated in Figure 2.

For theoretical purposes both Figure 1 and Figure 2 are carried out to the most extreme situation where only one tree growing above the alternative rate is left after the last thinning. This extreme situation is unlikely to be encountered in practical forest management, but it is somewhat approximated by the seed tree and shelterwood systems of even-aged stand managment, where the seed trees or shelterwood over-story are removed in two or more cuts during or after the reproduction period. The adaptability of the idealized models to these silvicultural systems is evidence of the universality of the basic models. For the seed tree and shelterwood situations part of the value increment of the few residual trees is derived from the value of their seed crops and site protection qualities during the reproduction period. Both Figure 1 and Figure 2 imply retaining individual trees (growing stock) whose value growth percents exceed the alternative rate during and after the reproduction period, so long as the overstory does not seriously impair the economic development of the new stock or stand. This form of even-aged management is approximated by the shelterwood system of white pine management on the Charles L. Pack Demonstration Forest at Warrensburg, New York and seems to be compatible with selective management for southern pine as carried on at the Crossett Experimental Forest of the U. S. Forest Service at Crossett, Arkansas.

If the procedures outlined above are followed for determining the first and subsequent thinnings, the stand should never contain trees earning below the alternative rate except when the additional earnings from the prospect of a heavier cut per acre are greater than earnings foregone on the value of such trees in alternative investments. If the forester takes this exception into account, it means that he is simultaneously maximizing returns from the prospective stumpage sale or logging operation as well as from the growing stock and alternative investment opportunities. Other exceptions may be similarly involved where other margins exist with respect to the disposition of the trees that are intrinsically financially mature. Under such circumstances, the basic economic principle for profit maximization calls for simultaneously balancing all marginal costs and marginal returns. If the forester follows these principles, the stand will tend to be stocked with the maximum value of individual trees growing at or above the alternative rate. The particular maximum of a stand, however, will be conditioned by the content and condition of the original stand, net income or savings in cost from sources other than the intrinsic earnings of the stand through growth, and the owner's alternative rate of return.

The Optimum Reproduction Age

The principles outlined to this point suggest an emphasis on the current stand condition and do not clearly point to an optimum rotation or reproduction age although that subject was considered earlier to a very limited extent. At this point optimum reproduction age seems to be a "wait and see" matter, which is not, by any means, altogether different from the type of even-aged management that is being practiced by many American foresters today.

If the current stand should be considered aside from the earning prospects of future stands in subsequent rotations, then the optimum rotation would occur at that age at which the volume or value of residual trees per acre earning at or above the alternative rate becomes too small to promise a commercially operable cut at a future date.[5] This follows from the fact that the value growth percent of the stand after thinning always exceeds, or at least equals, the alternative rate after thinning in accordance with the principles outlined above. Where thinning is an alternative to a final cut the expected growth percent of the stand before thinning is not an adequate guide to optimum rotation, since the possibility remains that there will be enough trees growing at or above the alternative rate after thinning to justify an operable cut at a later date.

The discussion to this point suggests that the application of the financial maturity principle to individual trees in a stand and the consideration of the requirements of a minimum operable cut provide an adequate guide to optimum rotation. This generalization has serious shortcomings, especially under intensive management conditions where thinnings are relatively frequent, minimum operable cuts low and soil values high. The shortcomings arise from the failure of the generalization to consider the earning prospects of future stands. Stated in light of the soil rent theory for rotation age, this situa-

[5] If a small residual volume were commercially operable but at a higher unit cost or lower unit stumpage price, then the optimum rotation age would occur when the net earnings per unit of time on the residual capital in excess of the alternative rate drop below the expected increase in cost of logging or loss in stumpage value in the same unit of time.

tion arises from the need to consider the prospective alternative of using the site and soil for a new rotation.

Ordinarily one would expect the forest owner to be interested not only in maximizing his returns from the current stand but also from the next stand as well, after he has given consideration to other earning possibilities. In other words, his rational economic objective lies in maximizing his earnings from the land and the other fixed resources associated with it such as roads. Thus, one of the alternatives to earnings from the present stand is the prospective earnings from a new stand managed at the same alternative rate. If income from the management of even-aged stands were realized each year, then we might expect the current annual income per unit area, much like current annual growth per acre, to rise for an extended period, culminate, and then to decline as total growing stock per acre is reduced by successive thinnings. Similarly, average annual income could be expected to rise and culminate but at a later age. These current and average annual income relationships are depicted by the model presented in Figure 3.[6] This model is derived from synthesized data presented in Table 2. The models of Figures 1 and 2 and data derived from cubic foot yield tables for managed stands provided the basis for synthesis.

Assuming that current income is realized annually from the beginning of a rotation, Figure 3 indicates that optimum reproduction age occurs when current annual income per unit area (from trees growing at or above the alternative rate) falls below the average annual income per unit area attained by the present stand. This assumes that the new stand will have the same productivity as the present stand. However, if the new stand should offer promise of different average annual income per acre the optimum reproduction age would occur when current annual income (from the present stand) is equated with maximum average annual income expected from the new stand. The foregoing general proposition holds under these assumptions because at ages beyond the indicated optimum, the current annual income from the present stand represents a poorer prospect than the expected average income of the new stand.

If the culmination of average annual value growth per unit area as just outlined is taken as the economically correct guide to optimum reproduction age, then one might infer that culmination of mean annual volume growth per unit area would be a reasonably close approximation of optimum reproduction age. The latter is used by some firms[7] in the South as a guide to reproduction age in pulpwood management. And this would seem reasonably correct where value per unit volume did not change with tree d.b.h.—a somewhat unlikely proposition except in the case of pulpwood management—and interest on growing stock value were not a direct cost of timber production. But the alternative rate of return represents a real economic cost (referred to by economists as the opportunity cost) in foregoing earnings on other investment alternatives including, among other possibilities, a new rotation of growing stock. Thus, annual value growth or income from growing trees at or above the alternative rate is not all net income in the rigorous economic sense. If growing stock were earning exactly and only the alternative rate at all times, then there would be no return to the fixed factors of timber production, usually referred to collectively as the soil or land.[8] Where a site has a positive net worth at a given alternative rate for future rotations, however, a new rotation is a better alternative than a current stand which is earning only the alternative rate on the value of its growing stock.

The maximization of total net returns in economic problems can be achieved by maximizing net earnings above all variable costs, i.e., the net returns to the fixed factors of production. It has been shown that the alternative rate is the best expression of the variable costs associated with carrying growing stock at one level or another from one year to another. Therefore, the earnings which should be maximized in such problems are those in excess of the alternative rate on the value of the growing stock. Total returns from forest areas will be a maximum over time, and optimum reproduction age will be determined, when net returns in excess of the alternative rate are equated with the corresponding average annual net returns realizable from future rotations. These future returns can be expressed as the product of the alternative rate and the maximum net worth of the land for growing future stands of timber. This concept or model for determining optimum reproduction age is represented graphically in Figure 4.

The maximum net worth of land for future stands of timber is determined according to the soil rent or soil expectation value calculation. The general formula, familiar to most foresters, is generally expressed in its simplest form as:

$$S = \frac{a}{(1.op)^u - 1} \text{ where}$$

S = net worth of land (soil rent or soil expectation value)

a = net returns at rotation age as determined by accumulating all incomes and costs to rotation age at the alternative rate of return

[6] This model should be familiar to foresters for it is analogous to that for demonstrating culmination of volume growth for even-aged stands as commonly derived from yield tables.

[7] See *Proceedings of Second Conference on Southern Industrial Forest Management*, School of Forestry, Duke University, Durham, N. C. 1956.

[8] The land owner, nevertheless, may realize all of the value growth as retained income or earnings from an accounting standpoint. The alternative rate ordinarily is not a cash or accounting cost, except where it may be determined by the interest charge on funds borrowed against the growing stock.

TABLE 2.—SYNTHESIZED DATA AND CALCULATIONS ILLUSTRATING EMPIRICAL COUNTERPART FOR PRINCIPLES AND MODELS DEVELOPED IN TEXT AND FIGURES

Age of stand in years	Value of growing stock per unit area			Current stand value growth percent[1]	Current annual periodic value growth	Average annual value growth	Net present worth of land for future rotations @ 5%[2]	Marginal cost[3]	Marginal revenue[4]
	Before thinning	After thinning	Thinning cut						
20	$115	$95	$20			$5.75	$37.48	$25.36	
				16.1	$21.00				$78.78
25	200	158	42			8.80	66.15	25.36	
				11.3	22.40				68.39
30	270	223	47			11.06	81.20	25.36	
				8.8	23.40				55.45
35	340	277	63			12.83	88.50	25.36	
				7.4	23.80				42.55
40	396	324	72			14.20	91.47	25.36	
				6.4	23.60				28.58
45	442	360	82			15.24	91.88	25.36	
				5.8	23.40				17.64
50	477	381	96			16.06	91.12	25.36	
				5.4	23.00				9.84
55	496	376	120			16.69	89.98	25.36	
				5.3	22.20				7.22
60	487	345	142			1715	88.99	25.36	
				5.2	20.00				4.78
65	445	290	155			17.37	88.11	25.36	
				5.1	16.40				1.96
70	372	216	156			17.30	87.35	25.36	
				5.0	12.00				0.39
75	276	107	169			16.95	86.73	25.36	
				5.1	6.00				[5]
80	137	22	115			16.26	86.23	25.36	
				4.9	1.10				[5]
85	28	0	28			15.38	85.86	25.36	

[1]Computed as $\frac{\text{Growing stock value at the end of the growth period and before thinning}}{\text{Growing stock value after thinning at beginning of growth period}} = 1.0p^5$

[2]Computed as the present worth of a perpetual periodic payment (rotation yield), first payment coming now plus the present worth of additional perpetual periodic payments (thinning yields), first payment coming in n years followed by the next payment t years from then. The general formula for each income is: $V_o = \frac{a + \frac{a}{(1.0p)^t - 1}}{(1.0p)^n}$

Establishment costs of $20 per unit area have been assumed but annual expenses omitted from the calculation.

[3]The net percent worth of land at optimum rotation age times 5% at 5 years (equivalent to 27.6%). For this case $91.88 times $(1.05)^5$.

[4]Current periodic value growth per unit area less 5% times growing stock for 5 years, $(1.05)^5$; i.e., less the cost of carrying the growing stock 5 additional years.

[5]Negative marginal revenues are obtained for these periods.

p = alternative rate of return
n = rotation length in years

According to the soil rent doctrine, when S is a maximum the corresponding n represents optimum reproduction age. The calculation, however, only takes future stands into account, implying an initial bare land situation for the determination of the optimum reproduction age. It fails to consider the potential earnings of an established stand.[9] The model of Figure 3, on the other hand, does take into account the potential earnings of an established stand and indicates the reproduction age at which net earnings will be maximized from both the established stand and potential future stands. The model has the advantage of providing a clear economic comparison between earnings from an existing stand and the potential earnings of a new stand as a criterion of optimum reproduction age for the present stand.

In this model for optimum reproduction age, the net current annual return which remains after the cost of carrying the growing stock at the alternative rate has been subtracted can be regarded as the marginal revenue associated with continuing an established even-aged stand. The product of the alternative rate and the net worth of the land for future rotations can be considered the marginal cost which results from foregoing the establishment of a new stand. The annual expense per unit area, usually represented by the symbol, e, in the soil rent formula, ordinarily can be regarded as a fixed annual cost common to both present and future

[9]The formula can be adapted to take the earnings of an established stand into account.

stands. As such it need not be taken into account in determining the marginal revenue and cost as described above, since it does not affect the determination of optimum reproduction age.

In Table 2 data are presented which follow the models of Figures 1 and 2 and provide for derivation of specific models analogous to those presented in Figures 3 and 4. The optimum reproduction age for the stand depicted by Table 2 is 45 years if based on the age at which the net worth of land for future rotations is a maximum. In this particular case the marginal analysis solution following the model of Figure 4 gives the same solution. An examination of the last two columns of Table 2 reveals that the marginal revenue, $17.64, falls below the marginal cost, $25.36, when the stand is 45-50 years of age indicating the optimum reproduction age as 45 years.

Final Implications

The optimum reproduction age as determined according to the marginal analysis model of Figure 4 or by the soil rent solution alone does not signify that the established stand if considered separately, has reached its economic optimum and is ready for the final cut. It signifies, on the contrary, that earnings per unit area of land will be maximized if a new stand is reproduced at that age; hence, it is referred to herein as optimum reproduction age.

The financial maturity principle applied to individual trees indicates that trees growing above the alternative rate should be retained one or more cutting cycles beyond reproduction age providing they will constitute one or more commercially operable cuts in the future. The seed-source and site protection values of potential residual trees should be taken into account in evaluating their financial maturity. However, once the new stand is regenerated an additional margin enters into the consideration. The value growth of residual trees over and above that necessary to satisfy the alternative rate must exceed the new margin in the form of the value of any negative effects the residual trees may have on the value growth of the newly established stand. In other words, the overstory cannot be retained if it seriously hampers the economic development of the new stand.

Where an overstory is compatible with development of a newly reproduced stand, theoretically a two-aged form of management for at least part of a rotation appears to be the optimum system of handling even-aged stands from an economic standpoint. One may hypothesize from this theoretical inference that a many-aged or all-aged system may be the optimum economic system of management where the species will grow satisfactorily under a partial overstory. These theoretical considerations, however, are subject to the practical circumstances bearing on the management and operating costs under the alternative systems of stand management. From the viewpoint of economic theory, such additional costs in effect introduce additional marginal costs not heretofore considered.

Earlier in this paper it was point-

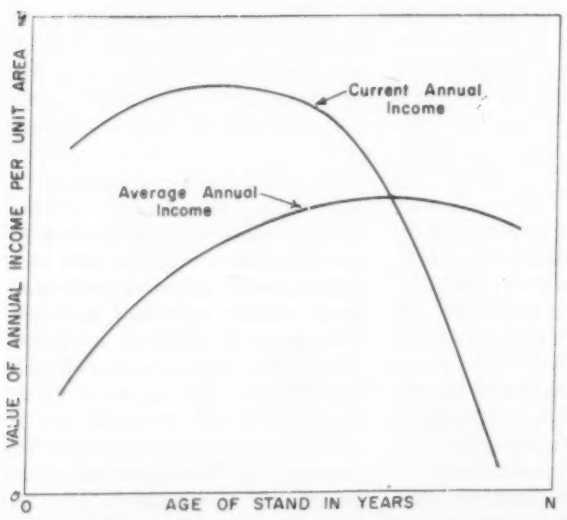

FIG. 3.—Generalized model showing trend of current and average annual income per unit area from trees growing at or above the alternative rate of return in even-aged stands. The model imples that the annual income from growth is realized currently, whereas it is actually being accumulated as growing stock or being realized, in part, periodically through thinnings.

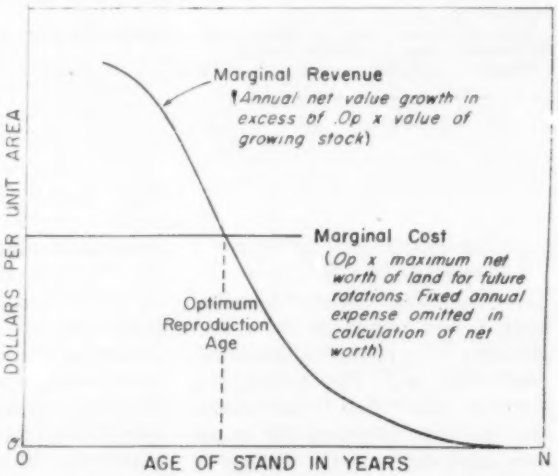
DOLLARS PER UNIT AREA
Marginal Revenue
(Annual net value growth in excess of .Op x value of growing stock)
Marginal Cost
(Op x maximum net worth of land for future rotations. Fixed annual expense omitted in calculation of net worth)
Optimum Reproduction Age
O
AGE OF STAND IN YEARS
N

FIG. 4.—Model for determination of optimum reproduction age for established even-aged stands. The details of the model can be adapted to a periodic earnings approach by substitution of $(1.op)^n$ for .op, the alternative rate, where n is the length of the period for which current periodic earnings are estimated. Fixed annual expenses do not need to be taken into account in determining marginal revenue or marginal cost, since the solution is not affected thereby. However, they must be omitted or included in both.

ed out that in following the financial maturity principle when managing even-aged stands, the forester would always tend to leave a maximum value of timber capital growing at or above the alternative rate in the residual stand. This principle of retaining a maximum value of timber capital earning at or above the alternative rate has been suggested as a guide to even-aged management and optimum stocking.[10] The fact that this is not exactly correct is implied in the development of this paper. This apparent incorrectness arises because the object of maximization should be the earnings per unit area from residual trees growing at or above the alternative and this is influenced by stocking.

The optimum stocking from an economic viewpoint for a particular stand will be the minimum values of timber capital earning at or above the alternative rate which will produce the maximum value growth per unit area that the particular stand is capable of producing. The particular point being that in removing some trees growing at or above the alternative rate, the value increment rate of others will increase in response to the lower stocking, which in reality amounts to better spacing of the residual capital with respect to other trees and the use of the site. If the response after thinning is great enough to equalize the effect of harvesting some trees growing above the alternative rate, no loss of earnings from the stand alone will arise from the lower stocking. On the other hand, the transfer of the excess capital to an alternative investment will increase the total earnings of the timber capital represented by the residual trees growing at or above the alternative rate after the thinning.

The principle of retaining a maximum value of timber capital earning at or above the alternative rate is compatible with the principle stated at the beginning of the above paragraph, if the former is regarded as including an explicit consideration of the effect of the spacing factor in determining financial maturity of individual trees. The concept set forth here, however, seems to express the ultimate object of maximization more directly with more thorough consideration of the conditions associated with such maximization. This concept also suggests that the marginal costs and revenues associated with spacing may be easier to study and take into account from the standpoint of the stand as a whole rather than through individual trees although in the last analysis the spacing will be established by selecting trees to cut and leave.

The influence of the spacing factor in maximizing earnings per acre in even-aged management can not be determined by economic models but must be worked out experimentally. It seems logical to assume, however, that it will be more important in the earlier thinnings and less so in the later. This suggests that the financial maturity principle will be more satisfactory as a solitary guide to optimum economic stocking in the later life of a stand, but that it requires judicious consideration of the marginal revenue associated with spacing alternatives in the early development of even-aged stands.

Finally, it should be emphasized that throughout this paper stocking has been measured and expressed in terms of value for unit area. That such stocking has its cubic foot, board foot, and cord volume counterparts is implicit. But, if we are to consider timber production as a business matter, the objects of maximization are dollar earnings per unit area within the range of biological possibility. Maximum value growth per unit area does not necessarily imply maximum volume growth as measured by any particular volume units. Maximum value growth per acre can have a volume growth counterpart that is less, perhaps even substantially less, than the maximum volume growth for the same stand. This becomes particularly important for stands capable of producing a variety of products and/or several grades of a particular product having different unit values. It is suggested, therefore, that basal area guides and similar physical guides that are based on concepts of stocking relating to volume growth be carefully evaluated with respect to their economic implications.

[10]Duerr, William A., John Fedkiw, and Sam Guttenberg. Financial maturity: a guide to profitable timber growing. Tech. Bul. No. 1146, U. S. Dept. Agric., 1956, pp. 26-29.

Fedkiw, John, and James G. Yoho. Financial maturity—what's it good for? Jour. Forestry 54:589. 1956.

Summary

Economic models have been presented which indicate the optimum time to thin and reproduce even-aged stands so as to maximize returns on the owner's capital over time. These models point out why biological or physical thinning guides may be irrational from the economic point of view and hence indicate the need for an economic framework for making decisions in thinning problems. Likewise, the models indicate how the most efficient use of forest land and associated fixed factors can be achieved over time by properly timing the replacement of the growing stock or capital.

The application of these models to the forest rests on the determination of the anticipated rate of value increment of individual trees in the stand and the alternative rate of the forest owner. In this respect the models do not depart from the basic financial maturity concept. The models go beyond this, however, by implying a notion of optimum economic density in even-aged stands which is defined to be the minimum value of timber capital earning at or above the alternative rate that will produce the maximum value growth per unit area that a particular stand is capable of producing at the given alternative. From the practical forest manager's point of view the models indicate economic optima with respect to the interval between thinnings, the amount to be removed at the time of thinning and the desired density or stocking. These considerations, moreover, need to

be weighed against their effect on the price of stumpage or costs of harvesting.

Thinnings can not continue indefinitely in even-aged stands, so that in maximizing returns over time, the problem of the optimum reproduction age arises. The models indicate optimum reproduction age occurs when a balance is achieved between the anticipated net return per unit area after thinning and the maximum potential average annual net return from a new stand.

The optimum time for the first thinning in an even-aged stand is defined as the time when the volume of trees earning below the owner's alternative rate (trees which individually are financially mature) constitutes an economically operable cut. When the stand again reaches this same state of development another economical thinning is indicated. The application of this concept, however, needs to take into account the value increment associated with alternative spacing possibilities, a consideration which is likely more important in earlier thinnings and less so in later thinnings. Changes in the per unit price or operating costs associated with the size of the sale may introduce an additional margin which will tend to delay the time of thinning, or increase the interval between thinnings or indicate a larger volume to be financially mature. Correct application of these principles to established stands will tend to leave a residual stand having or approaching optimum economic density. When the residual stand is made up predominantly of trees growing *above* the owner's alternative rate, the stand is under stocked from an economic point of view. Such stands should ordinarily be continued and growing stock accumulated, so long as the residual trees continue to grow above the alternative rate.

The optimum reproduction age occurs when current annual income per unit area from trees growing at or above the alternative rate falls below the maximum potential average annual income per unit area from a possible series of new stands. The best expression of the maximum income potential of new stands is the annual net worth of future rotations (fixed costs omitted) multiplied by the owner's alternative rate. This yields a result quite analagous to the familiar notion of annual soil rent. The equating of the two quantities, however, gives superior results to those obtained from the soil rent doctrine alone inasmuch as the current earnings of the present stand are taken into consideration. It is pointed out finally that trees earning above the alternative rate may be left during and after the reproduction period. The overstory, however, must be compatible with the optimum economic development of the new stand and the requirements of an economic cut under that circumstance and after seed source and site protection values are taken into account.

Southern Agricultural Workers Meet

The annual meeting of the Forestry Section of the Association of Southern Agricultural Workers will be held at the Dinkler-Tutwiler Hotel in Birmingham, Ala., February 1-2.

The program will include, among others, papers on forestry education, public relations, use of mass media, control of undesirable species, artificial regeneration, stand density-soil moisture relationships, and quality seed production.

The meeting is open to everyone.

Effect of Gibberellin on Height Growth of One-Year Old Seedlings of Loblolly Pine

M. Victor Bilan
and Arne K. Kemp

IN RECENT YEARS the use of gibberellin by plant scientists has created much excitement and speculation, particularly in agricultural and horticultural circles. Numerous experiments with various plants have been carried out studying the effect of gibberellin on height growth, initiation of flower buds, fruit setting and breaking dormancy.

Relatively little work has been done in studying the effect of gibberellin on growth of forest tree species. Some of the experiments with broadleaf species gave quite spectacular results, but the growth of conifers seemed to be but little affected by the gibberellin compounds. After reviewing studies dealing with the effect of gibberellin on coniferous tree species, Westing (*7*) concluded that the results were "generally negative."

Marth, Audia and Mitchell (*4*) reported that height growth of Japanese maple (*Acer palmatum* L.), sugar maple (*Acer saccharum* Marsh.), willow oak (*Quercus phellos* L.), yellow-poplar (*Liriodendron tulipifera* L.) and poplar hybrid (Populus, USDA Hvbrid 247) was increased between 40 and 400 percent by treating the stems of seedlings with lanolin paste containing 0.125 to 1.0 percent of gibberellic acid. The same authors reported that less success was achieved by experimenting with seeedlings of loblolly pine (*Pinus taeda* L.), Virginia pine (*Pinus virginiana* Mill.) and eastern white pine (*Pinus strobus* L.). Height growth of loblolly pines was not affected by either soaking the roots in the solution containing 1, 10, or 100 p.p.m. of gibberellic acid, or by treating the stems with lanolin paste containing 0.25, 0.5 or 1.0 percent of gibberellic acid. Height growth of seedlings was increased 0 to 40 percent by spraying the shoots with a 400 p.p.m. solution of gibberellic acid. Height growth of established seedlings of Virginia pine was increased 28 to 68 percent by treating the stems with the paste of lanolin containing 0.25 percent of gibberellic acid, but newly transplanted seedlings failed to respond. Treatment of either new growth or old stems of eastern white pine with lanolin paste containing 0.25 to 1.0 percent of gibberellic acid failed to increase the growth.

By applying 1-percent solution of gibberellic acid in lanolin to the stems of eleven southern tree species, Nelson (*5*) was able to increase significantly the height growth of eastern cottonwood (*Populus deltoides* Bartr.), American sycamore (*Platanus occidentalis* L.), yellow-poplar (*Liriodendron tulipifera* L.), sweet gum (*Liquidambar styraciflua* L.), cherry bark oak (*Quercus falcata* var. *pagodaefolia* Ell.), willow oak (*Quercus phellos* L.) and southern red oak (*Quercus falcata* Michx.). Further, the above treatment failed to increase significantly the height growth of eastern white pine (*Pinus strobus* L.) and damaged the seedlings of Arizona cypress (*Cupressus arizonica* Greene).

According to Knight (*2*), repeated spraying of 1-0 old Engelmann spruce (*Picea engelmannii* Parry) seedlings and of first-year seedlings of western hemlock (*Tsuga heterophylla* [Raf.] Sarg.) with 10, 100, and 1,000 p.p.m. potassium gibberellate-water solution did not increase growth of either shoots or roots. Schoedle (*6*) reported that growth of 1-0 old Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco) was reduced by repeated spraying with 125, 250, and 500 p.p.m. solution of gibberellic acid.

Using concentrations of gibberellic acid of 10, 30, 60, 100 and 1,000 parts per million, Hoeskaylo and Murphey (*1*) introduced the solutions directly into the trunk xylem of 9-year-old McKee hybrid poplar trees during the normal growing season. The treatments did not affect height or diameter growth of the trees.

The above review indicates that all of the experiments have been conducted using gibberellic acid concentrations of 1.0 percent or less. This report presents the analysis of height-growth data of one-year-old loblolly pine seedlings which were treated with gibberellic acid concentrations of 1.0, 2.0 and 3.0 percent.

Description of Study

Aqueous solutions of gibberellin[1] of 0, 1.0, 2.0 and 3.0 percent were prepared in 1000-cc glass cylinders. The gibberellin was first dissolved in alcohol using 15 mg of sodium bicarbonate and 2 cc of 95% ethyl alcohol for each gram of gibberellin. The obtained concentrate then was accordingly diluted with the tap water. Thirty grams of gibberellin powder were used to prepare 500 cc of each solution.

One-year old seedlings of loblolly pine (*Pinus taeda* L.) were lifted from the nursery bed one day before treatment, January 13, 1958. The experimental stock of 120 seedlings was randomly distributed over 24 bunches, five seedlings in each. Six bunches were treated in each cylinder containing solution;

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[1]Contributed by Chas. Pfizer & Co., Inc., Brooklyn 6, N. Y.

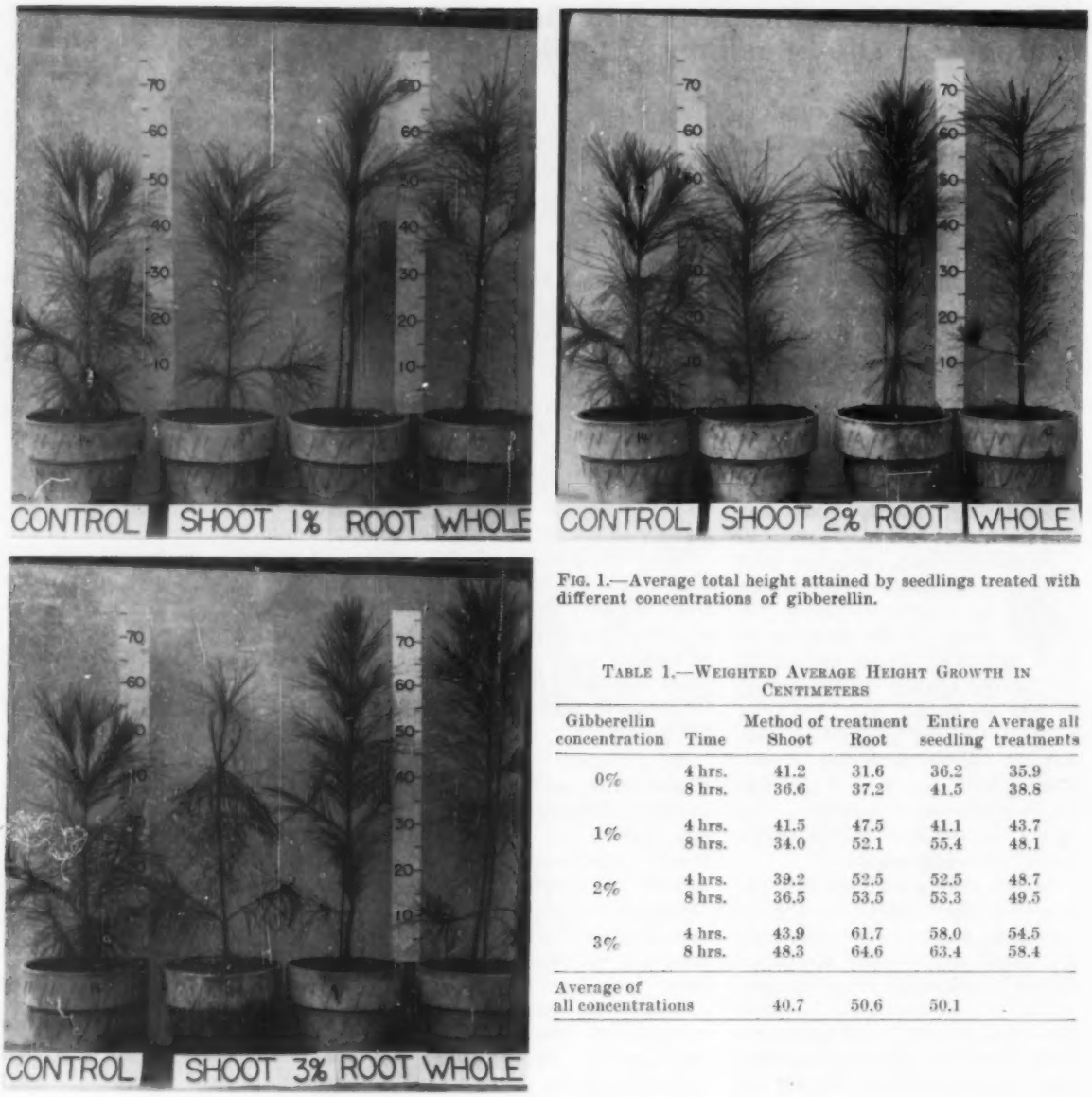

FIG. 1.—Average total height attained by seedlings treated with different concentrations of gibberellin.

TABLE 1.—WEIGHTED AVERAGE HEIGHT GROWTH IN CENTIMETERS

Gibberellin concentration	Time	Method of treatment Shoot	Root	Entire seedling	Average all treatments
0%	4 hrs.	41.2	31.6	36.2	35.9
	8 hrs.	36.6	37.2	41.5	38.8
1%	4 hrs.	41.5	47.5	41.1	43.7
	8 hrs.	34.0	52.1	55.4	48.1
2%	4 hrs.	39.2	52.5	52.5	48.7
	8 hrs.	36.5	53.5	53.3	49.5
3%	4 hrs.	43.9	61.7	58.0	54.5
	8 hrs.	48.3	64.6	63.4	58.4
Average of all concentrations		40.7	50.6	50.1	

two bunches were submerged completely while only shoots or roots of the remaining four bunches were submerged in the solution. Half of the seedlings were treated for four hours, and the remaining half for eight hours. It is worthwhile to mention that an average of about 2 cc of solution was utilized by each treated seedling. The unutilized solutions were not tested to determine if the dipped seedlings had altered the original concentrations.

After treatment the seedlings were planted immediately in 10-inch clay pots filled with sandy-loam top soil and placed in a heated greenhouse until the end of April after which they were placed outdoors.

Original height and weekly growth of individual seedlings were measured and recorded in centimeters. To preserve consistency all measurements were made from the top edge of the pots. The final measurements were taken on September 18, 1958. The difference between original height and the last measurement was considered as the growth caused by the imposed treatments. These data were analyzed statistically according to a split-plot method.

Various agencies caused death of 10 seedlings, but the mortality was distributed randomly and did not seem to be associated with any particular treatment. The loss was accounted for in the statistical analysis of data by introducing proper weights and by reducing correspondingly the degrees of freedom. The weighted average height growth of individual treatments is presented in Table 1.

Discussion

The average height growth of seedlings treated for eight hours was, in most cases, slightly higher than the height growth of seedlings treated only for four hours; however, the difference was not sufficient to be statistically significant.

Analysis of variance revealed that both the method of treatment and the concentration of gibberellin in solution were highly significant factors.

Treatment of the roots or of the entire seedlings stimulated height growth significantly more than did the treatment of the shoots alone (Fig. 1). On the other hand, no significant differences existed between the treatments of the roots and of the entire seedlings. The average height growth of shoot, root, and entirely-treated seedlings was 41 cm., 51 cm. and 50 cm. respectively.

Each of the three concentrations of gibberellin stimulated height growth of treated seedlings. The three-percent concentration was significantly better than the other two concentrations, but the two-percent solution was no more effective than the one-percent solution. The average height growth of seedlings treated in the solution of zero, one, two, and three-percent concentration of gibberellin was 37 cm., 46 cm., 49 cm. and 56 cm., respectively.

It appears that, at least during the dormant season, dipping of the roots of loblolly pine seedlings in the solution containing at least one percent of gibberellin stimulates the subsequent height growth more effectively than the dipping of the shoots.

As indicated in Table 2, shoots treated in one or two-percent solution of gibberellin did not respond with an accelerated rate of growth. Shoot-treatment in a three-percent gibberellin solution resulted in a significant increase in height growth, but the increase was considerably less than that of root-treated seedlings in a one-percent solution.

TABLE 2.—AVERAGE HEIGHT GROWTH PER TREATMENT AND CONCENTRATION DISREGARDING THE DURATION OF TREATMENT

Concentration of gibberellin	Average height growth in centimeters				Average height growth as percentage of average for control (37.3)			
	Shoot	Root	Entire seedling	All treatments	Shoot	Root	Whole	All treatments
Control	38.6	34.7	38.9	37.3				100.0
1%	38.4	49.8	49.1	45.9	102.9	133.5	131.6	123.1
2%	38.1	53.0	52.9	49.1	102.1	142.1	141.8	131.6
3%	46.1	63.2	60.4	56.4	123.6	169.4	161.9	151.2

It is believed that the failure of the shoot treatment to cause increased height growth can be attributed to the vegetative condition and anatomical structure of the treated loblolly pines. In order to influence growth it appears logical to assume that gibberellin has to enter into the living cells or at least into the living tissue. Since shoots of treated seedlings were in a dormant condition, there was no young tissue exposed to the gibberellin. The well-protected buds and heavy epidermis of the mature needles evidently impeded the entrance of gibberellin into the living tissue.

The situation was quite different in the case of root treatment. The roots were actively growing and much of the unlignified tissue was exposed to the gibberellin solution. The absorption of water and probably gibberellin was enhanced also by the transpiring shoots being exposed to the room temperature.

In addition to height growth, gibberellin also produced some other morphological changes in the treated seedlings. As the concentration of gibberellin solution was increased, the number and length of the lateral branches decreased; the needles became lighter in color and tended to show a more pronounced alignment with the longitudinal axis of the stem.

Summary

One-year old seedlings of loblolly pine were treated with one, two, or three-percent aqueous solutions of gibberellin. Either roots, or shoots, or entire seedlings were soaked in a solution for four or eight hours. No significant differences existed between height growth of four and eight-hour treated seedlings.

Each of the three used concentrations increased height growth of root or entirely-treated seedlings, the increase being proportional to the higher concentration of gibberellin in the solution.

The shoot-treated seedlings responded only to the highest concentration of gibberellin.

In addition to height growth, gibberellin produced also other morphological changes in the treated seedlings.

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Survival and Growth of Graded Longleaf Pine Nursery Stock

R. D. Shipman

THE CAROLINA-GEORGIA sandhills are among the most difficult planting sites in the South. Poor survival has characterized most plantings of the native longleaf pine (*Pinus palustris*). However, a study by the Southeastern Forest Experiment Station shows that successful establishment and growth of planted longleaf pine may depend largely on size and form of seedlings used. In the absence of other criteria, it appears that morphological grade can be used by nurserymen and planters for evaluating drought hardiness and vigor of longleaf pine planting stock.

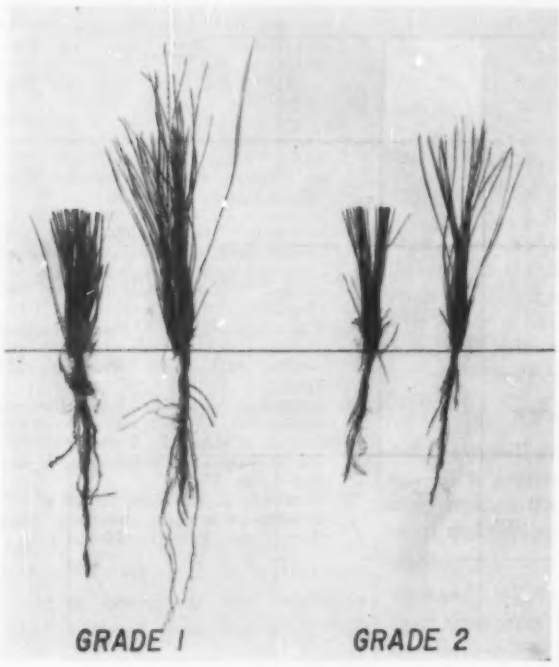
Morphological grades tested in this study were developed by Wakeley as follows (*5*) (**Fig. 1**):

Grade 1—Top 12 to 16 inches high; stem ¼ to ½ inch at ground line; needles abundant, almost all in 2's and 3's; winter buds present.

Grade 2—Top 8 to 15 inches high; stem at least 3/16 inch at ground line; needles moderately abundant, at least part in 2's and 3's; buds with scales usually lacking.

The experiment was installed early in 1953 at the Atomic Energy Commission's Savannah River Project near Aiken, S. C. Plot locations were level old fields abandoned about six years and occupied by a cover of annual weeds, broomsedge (*Andropogon* spp.) and wiregrass (*Aristida stricta*). Six 1/5-acre plots were established, three on sandy loams and three on deep sand. Each plot contained eight randomized subplots, four planted in January and four planted in March. These were equally divided by seedling grades and seedling treatment (needles clipped to 5 inches and needles unclipped). Thus, each subplot contained 50 trees, totalling, 2,400 for the experiment. All were hand-planted at a 4 by 4 foot spacing. The 1-0 planting stock was grown at the Stuart Nursery in Louisiana

THE AUTHOR is associate professor of Forestry, Forestry Department, Clemson College, Clemson, S. C.



Left

FIG. 1.—Longleaf pine planting stock, morphological grades 1 and 2. One-half of each grade was foliage-clipped to 5 inches in length. Horizontal and vertical lines are 4 inches apart.

Right

FIG. 2.—Survival of planted 1-0 longleaf pine by morphological grade and soil type.

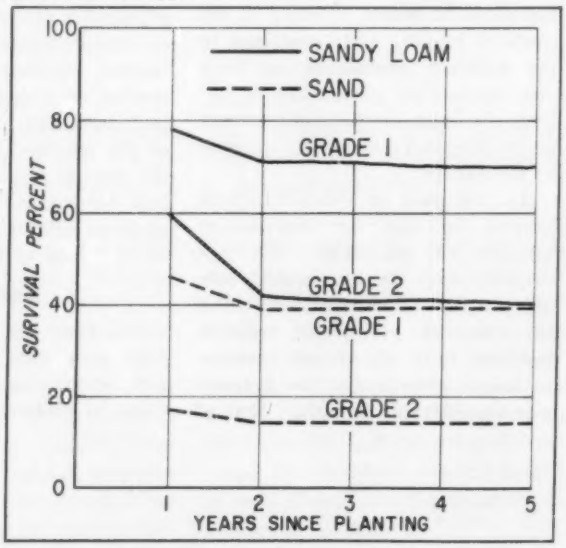


TABLE 1.—AVERAGE SECOND-YEAR SURVIVAL OF PLANTED LONGLEAF PINE, ACCORDING TO SEEDLING GRADES, SOIL TYPE, AND SEASON OF PLANTING

Seedling grade	Soil type	Survival	
		Winter-planted	Spring-planted
1	Sandy loam[1]	76	66
	Sand[2]	40	38
2	Sandy loam	58	27
	Sand	18	10

[1]18 inches or less to clay layer.
[2]36 inches or more to clay layer.

TABLE 2.—EFFECT OF SEEDLING GRADES ON THE 5-YEAR HEIGHT GROWTH OF PLANTED LONGLEAF PINE

Height in feet	Total surviving trees	
	Grade 1	Grade 2
	Percent	
0.0- 0.9	7.2	8.2
1.0- 3.9	17.3	28.5
4.0- 6.9	35.5	47.8
7.0- 9.9	33.6	14.8
10.0-12.9	6.4	.7

from seed collected near the planting sites.

Rain gages and soil thermometers were placed at each plot location. Also, at approximately three-week intervals, soil moisture measurements were taken at 2- and 6-inch depths on each plot throughout the growing season. Although the average rainfall is 45 inches a year, a rain-free interval of three to four weeks may occur at any time during the critical growing season months of May, June, and July. In 1953, the local climatic record showed a scant .06 inch of rain between May 8 and June 6. During this same period, the lowest soil moisture levels, and highest soil temperatures of the season occurred. In May, surface soil temperatures on deep sands rose to 145° F., while moisture levels were as low as 1 percent. These conditions put all grades of planting stock to a severe test during the early part of the first growing season. Climate during the second growing season after planting was equally difficult on seedling survival. In fact, the growing season of 1954 was the hottest on record.

Seedling Survival

Top-grade longleaf pine seedlings proved most capable of withstanding the full impact of these climatic extremes. This is borne out by the survival at the end of the second growing season which, for grade 1 seedlings, was significantly better[1] than that of grade 2 seedlings grown under similar conditions of soil and planting season (Table 1).

Season of planting had only a small effect on the survival of grade 1 seedlings, the results from spring planting being only slightly poorer than those of winter. In contrast, spring-planted grade 2 seedlings had a significantly[2] poorer survival than similar seedlings planted in the winter. Apparently these smaller seedlings lacked the necessary vigor to become established during the short interval between March and the advent of the hot, dry early growing season of the first year.

[1]At 1 percent level of probability.
[2]At 5 percent level of probability.

On similar soils, grade 1 seedlings survived consistently better than grade 2. However, grade 2 seedlings planted on sandy loam survived somewhat better than grade 1 stock on sand. In this case the factors associated with a better site outweighed any advantages of seedling morphology on the poorer site.

Regardless of seedling grade, very little mortality occurred from the second through the fifth growing season and the early survival advantages of the better grade seedlings were maintained (Fig. 2).

Clipping the foliage to 5 inches in length had little or no effect on over-all survival. For reasons unknown, any benefit from foliage clipping showed up on winter-planted stock, while adverse effects were noted on spring plantings. However, other studies indicate that clipping the foliage to 1/3 the natural length is beneficial (*1*), pointing to the need for additional study of foliage clipping at least in this locality.

FIG. 3.—Planted longleaf pine after 5 growing seasons: *left*, grade 2 seedlings, average height 5.1 feet; *right*, grade 1 seedlings on same site as *left*, average height 7.0 feet.

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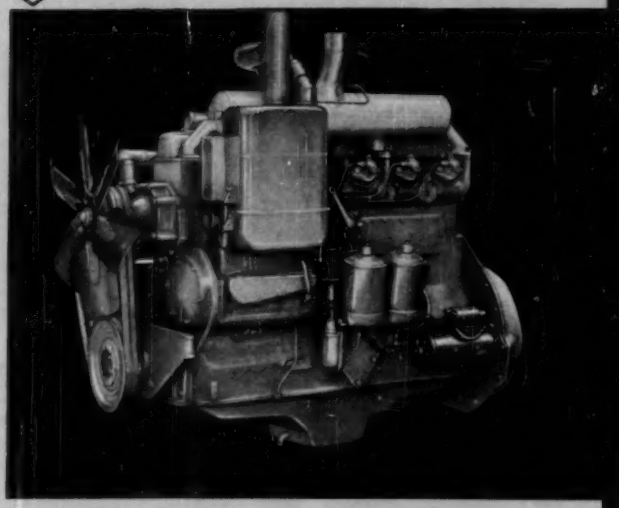

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On contract logging, the Clark Wallace operation skids to the landing and loads out 30,000 bf of Western pine and fir daily. All loading is done with an International Drott Skid-Grapple.

The best survival of longleaf pine in the Carolina-Georgia sandhills results from planting grade 1 seedlings on either sands or sandy loam soils of the Sandhill Region regardless of planting date in the dormant season. The most effective use of longleaf pine planting stock—assuming one has a choice—is to plant either grade of seedling on sandy loam soils in mid-dormant season. In the case of grade 2 seedlings, this appears to be a must, because planting on deep sand or late in the season invites heavy seedling losses.

Seedling Growth

The acid test for planted longleaf pine is to have most seedlings making height growth. The trees generally remain in the grass stage until the stems reach a diameter of approximately 1 inch at the ground line. Small seedlings may remain in the grass for many years, particularly where there is severe competition. Planting large seedlings should shorten the period considerably.

On the average, grade 1 seedlings maintained a 1.9-foot height advantage over the smaller grade 2 stock (Table 2 and Fig. 3). At the end of 5 growing seasons, 40 percent of the grade 1 trees were 7 feet tall or better; only 16 percent of grade 2 seedlings could meet these standards. The maximum height obtained for grade 1 was 12.8 feet and 10.4 feet for grade 2. It is too early to tell whether this initial height growth advantage of the better morphological grade will continue.

Discussion and Summary

Similar marked differences in survival and growth attributed to seedling grades have been reported by at least several workers. Hough (*3*) found that larger seedlings not only grew faster initially, but after 10 years had increased their growth rate over smaller stock. In the Lake States, Rudolph (*4*), working with red pine, showed that first-year survival was poorer with small stock. Doyle and Olson (*2*) indicate that grading yellow-poplar seedlings before planting can make the difference between success and failure of establishment in the Piedmont Region. All of this suggests that the true economic basis for successful plantation establishment begins in the nursery—the development of highest quality seedlings that will survive and grow when outplanted.

Currently, researchers are attempting to establish techniques for developing non-visible physiological characteristics which will result in more drought-hardy stock (*6*). However, until this is accomplished, stem size and general appearance (morphological grade) of longleaf pine appear to be highly useful ocular guides for planting on dry sandhill areas.

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National Wildlife Week Is Scheduled March 20-26

The annual observance of National Wildlife Week has been scheduled for the period March 20-26, 1960, under the sponsorship of the National Wildlife Federation and its affiliates in 49 states and the District of Columbia. Announcement of the dates was made by the Federation's executive director, Ernest F. Swift.

National Wildlife Week has been sponsored annually by the National Wildlife Federation since 1938. The annual observance highlights conservation problems relating to natural resources and effects upon species of wildlife.

Water conservation will be featured as the theme for the 1960 Wildlife Week observance. Slogan for the observance will be: "Water—Key to Your Survival."

Notes and Observations

A Sowing Rate Computer for Southern Nurseries

Upon receipt of data from the seed testing laboratory, the nurseryman is confronted with the task of determining the correct seed sowing rate. This sowing rate can be calculated as the number of seeds to sow per square foot of nursery bed or the weight of seed to sow per given length of standard width bed. The sowing rate is usually computed only once a year, or possibly once every two years. Desired density, germination percentage and expected survival percentage are used in determining the number of seed per square foot. Area of bed, desired density, number of seeds per pound, germination percentage, expected survival percentage and seed purity are used in determining the weight of seed per unit area.

In an attempt to assist the southern nurseryman in sowing rate calculations, a loblolly and slash pine sowing rate computer has been devised. The computer is a series of logarithmic scales of the various sowing factors reproduced on circular dials of cardboard. Starting with the smallest dial, the factors are entered on successively larger dials until the sowing rate is indicated by the arrow on the largest circular dial. On one side of the computer (Fig. 1) the sowing rate by weight of seed per one hundred linear feet of bed, four feet wide, can be determined. On the other side the sowing rate by number of seed per square foot of bed can be determined. If properly used, the precision of the sowing rate will be within 0.01 pound and less than one seed.

As an example, assume a desired density of 40 seedlings per square foot, from a lot of slash pine seed germinating 80 percent and with 95 percent purity. Assume further an expected survival of 80 percent and a known number of 15,000 seeds per pound. Setting the dials in succession according to directions, in the manner shown in Figure 1, gives a sowing rate of 1.75 pounds of seed to sow per 100 feet of four foot wide bed, as shown on the outermost dial. A similar procedure can be followed with the other side of the rule to determine sowing rate in terms of seeds per square foot. Again assume a desired density of 40 seedlings per square foot from a lot of

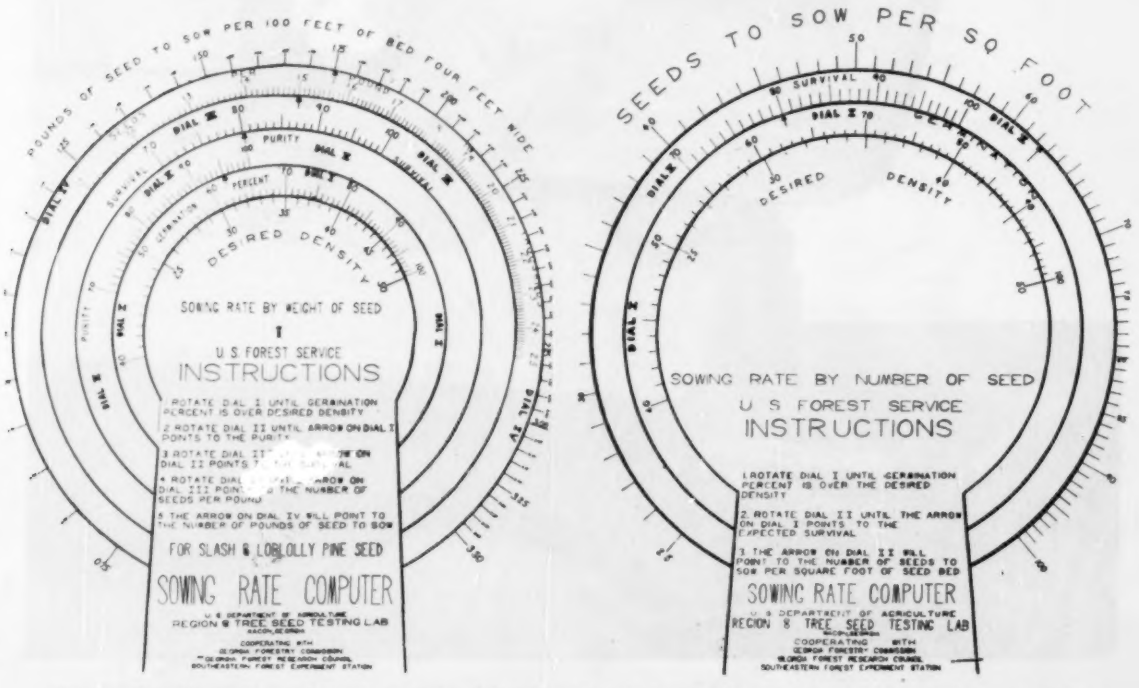
POUNDS OF SEED TO SOW PER 100 FEET OF BED FOUR FEET WIDE
DESIRED DENSITY
SOWING RATE BY WEIGHT OF SEED
U. S. FOREST SERVICE
INSTRUCTIONS
FOR SLASH & LOBLOLLY PINE SEED
SOWING RATE COMPUTER
SEEDS TO SOW PER SQ FOOT
DESIRED DENSITY
SOWING RATE BY NUMBER OF SEED
U. S. FOREST SERVICE
INSTRUCTIONS
SOWING RATE COMPUTER

FIG. 1.—One side of the sowing rate computer determines the rate by weight of seed per 100 feet of nursery bed (left) while the other side determines the rate by seeds per square foot (right).

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slash pine seed germinating 80 percent with an expected survival of 80 percent. The sowing rate would be 63 seeds per square foot of bed.

This computer was designed for use with slash and loblolly pine seed. However, it could be easily adapted for use with other species by changing the maximum and minimum values upon the seeds per pound and weight of seed to sow dials. For example, the values on the present seeds per pound dial range from 11,000 to 25,000 which limit the sowing rate by weight determination to species with seed of this size. The sowing rate by number of setds per square foot could be used for any species to be grown with a bed density falling within a range of 25 to 50 seedlings per square foot.

In 1958 this computer was reproduced and distributed to all southern nurseries by the Regional Office, Southern Region, U. S. Forest Service. It is hoped the sowing rate computer will accomplish two purposes: first, to assist the nurseryman in proper use of seed testing data and second, to encourage the use of more than one sowing rate for a lot of seed. Almost all nurseries have areas that are below average in seedling production and need special sowing rates to bring them up to standard production.

THOMAS F. SWOFFORD
Region 8 Tree Seed Testing Laboratory, Southern Region, Forest Service, U. S. Department of Agriculture

Lumber Downgrading Losses Due To Insect Damage To Small Unseasoned Pine Sawlogs[1]

When autumn hurricanes occur in New England, uprooted and broken pine timber left outdoors during the following spring and summer is injured by various insects which dig tunnels through the bark and wood. After the hurricane of September 1954 in southeastern Massachusetts, it was thought desirable to obtain information on differences in grade yield and value of lumber sawed from: (1) unprotected logs which become damaged by such wood-boring insect pests of unseasoned logs and (2) logs which were protected against such insect damage with a BHC emulsion spray. It had already been demonstrated that a BHC spray, especially in oil solution, gave excellent long-term protection against some insect pests of unseasoned logs in the southeastern United States (*5*) and that one spray application of a BHC emulsion (diluted in water) before insects attack in the spring gave excellent to complete protection all summer against insect pests of unseasoned pine logs in Massachusetts (*3, 4*).

Procedure

In the early spring of 1955, hurricane felled eastern white pines (*Pinus strobus* L.) at Pembroke, Massachusetts were sawed into logs and left scattered about the woods.

Each log which was to be protected against insect damage was sprayed individually and completely, where it lay, with a commercially prepared BHC emulsifiable liquid concentrate diluted in water to 0.4 percent gamma isomer content by volume. No records were kept of the cost of the treatment because it was not intended to be on a commercial basis.

Forty logs, which contained a total of 1,006 board feet of lumber, were sprayed on April 20, 1955. After a rainy period, forty additional logs, which contained a total of 1,219 board feet, were similarly sprayed on May 2. Forty additional logs, which contained 904 board feet of lumber, were left unsprayed for comparison.

The test logs were small in diameter, varying from 5 to 11 inches at the smaller end. The various diameter classes were distributed as equally as possible among the three groups of logs.

After lying in the woods exposed to insect attack from spring to autumn, on November 17, 1955 all test logs were sawed into boards 1 inch thick at the sawmill unit of a box manufacturing plant. All saw cuts were parallel. Consequently, all lumber was round edge. The next day, the lumber was

[1]Contribution No. 1149 of the Massachusetts Agricultural Experiment Station and Entomological Contribution No. 1324 from the Department of Entomology and Plant Pathology at the University of Massachusetts.

The authors are indebted to the Lot Phillips Corporation for their cooperation in making this study possible.

TABLE 1.—GRADE YIELD AND VALUE OF EASTERN WHITE PINE LUMBER SAWED FROM WORM-HOLE-FREE LOGS (PROTECTED WITH BHC SPRAY) AND BORER-DAMAGED LOGS (UNSPRAYED) LEFT IN THE WOODS AT PEMBROKE, MASSACHUSETTS, FROM AUTUMN TO AUTUMN (1954-1955)

Source of lumber	Board feet of lumber in logs	Percentage of lumber in each grade					Total value value per M.B.F.
		D Select & better	No. 1 & 2 Common (Finish)	No. 3 Common (Premium)	No. 4 Common (Standard)	No. 5 Common (Industrial)	
Average f.o.b. wholesale value per M.B.F. of each grade of lumber		*$200*	*$160*	*$125*	*$90*	*$50*	———
Logs sprayed 4-20-55 (Worm holes absent)	1,006	2.0	8.1	46.0	40.2	3.7[1]	$112.49
Logs sprayed 5-2-55 (Worm holes absent)	1,219	2.5	26.3	46.9	21.8	2.5[1]	$126.58
Unsprayed logs (If worm holes absent)	904	0.8	5.1	44.8	46.2	3.1[1]	$108.89
Unsprayed logs (Worm holes present)	904	0.8	2.1	9.5	24.8	62.8	$ 70.56

[1]In these instances, downgrading to No. 5 Common was due entirely to decay or to splits caused by wind damage to the hurricane felled timber.

graded by an experienced lumber grader in accordance with the standard grading rules (1948 revision) of the Northeastern Lumber Manufacturer's Association, Inc. (*2*).

Although all boards were round edge, they were graded and tallied for volume on the basis of their square edge yield to permit elimination of wane as a defect. Separate records were kept of downgrading due to worm holes as distinct from decay, knots, and other defects which also reduce the value of lumber. Each insect-damaged board was given two grade designations: (1) the grade in which it would have been placed if no worm holes had been present and (2) the grade in which it actually was placed because of worm holes.

Results

In unsprayed logs of all diameter classes available in this test (11-inch maximum), large worm holes, principally caused by certain round-headed borers (Cerambycidae), especially the pine sawyer beetle, *Monochamus scutellatus* Say, commonly penetrated to or near the center of the xylem. Pinworm holes, caused by the ambrosia beetle *Gnathotrichus materiarius* Fitch (Scolytidae), did not penetrate the xylem more than an estimated 2 inches.

Since all saw cuts were parallel, all boards, at least along the edges, contained some wood from the outer xylem which may be injured by both types of insects. In the wider boards, the central strip (which is sawed from the inner xylem of logs of the larger diameter classes) could contain large worm holes but not pinworm holes. In the unsprayed logs in this test, 64 percent of the total volume downgraded due to insect damage was attributed to large worm holes and 36 percent to pinworm holes.

The spray treatments prevented damage by all wood-boring insects in this experiment. Consequently, there was no downgrading due to worm holes. The worm-hole-free lumber from the two sprayed groups was valued at $112.49 and $126.58 per M.B.F., respectively, based on average f.o.b. wholesale price quotations for the various grades of lumber[2] in the *Commercial Bulletin* for October 11, 1958 (*1*). Since insect damage was not involved, such values would vary with the presence or absence of other defects in the lumber.

The lumber from the unsprayed logs would have been worth $108.89 per M.B.F. if no worm holes had been present. However, downgrading due to the actual presence of worm holes resulted in a grade yield which had a monetary value of only $70.56 per M.B.F. Consequently, under the conditions of this test, insect pests of unseasoned logs caused a loss of $38.33 per M.B.F. or 35.2 percent in these logs which were not of high quality before the insects damaged them. Such losses, of course, would vary with the original quality of the logs and the extent of damage by the insects. For example, there is a much greater loss when worm holes downgrade a D Select board to No. 5 Common than when they downgrade a No. 4 Common board to No. 5 Common. Likewise, there is more loss when serious insect damage downgrades a board from one of the higher grades to No. 5 Common than when very slight insect damage downgrades a comparable board to No. 4 Common.

The actual grade yield and value per M.B.F. of the worm-hole-free lumber from the two groups of sprayed logs and the insect-damaged lumber from the unsprayed logs are compared in Table 1. The table also shows the grade yield and value of the lumber from the unsprayed logs if no worm holes had been present.

[2]The price of No. 5 Common is based on reliable estimates by several New England lumbermen because no prices were quoted in the *Commercial Bulletin* for this grade.

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Department of Entomology and Plant Pathology and Department of Forestry and Wildlife Management respectively, University of Massachusetts, Amherst

Forest Damage by Wild Animals

Ernest L. Kolbe, forester for the Western Pine Association, Portland, Ore., was the representative of the Society of American Foresters to a meeting held in Washington, D. C. on November 4 and 5, 1959, of the Subcommittee on Vertebrates of the Committee on Agricultural Pests, of the National Research Council.

A goal of this subcommittee is to encourage interested agencies and organizations to assess adequately the losses caused by wild animals to agriculture, forest and range lands, and industries dependent on these resources.

It is expected that the Society's interests and activities in respect to forest damage by wild animals will be centered in the Division of Forest-Wildlife Management.

Book Reviews

Ground Water Hydrology

By David K. Todd. 336 pp. Illus. John Wiley & Sons, Inc. New York. 1959. $10.75.

The non-expert—the civil engineer, the soil scientist, and the forester—each will find contact with his own specialty in this book on ground water hydrology. The author has digested over 700 references in a way that makes for easy assimilation. Simple charts and diagrams and straightforward prose make each concept, principle, and practical consequence easy to understand. Most of the facts come from United States data, particularly California which has about ¼ of the total ground water use. However, the author brings in European illustrations where these are pertinent.

The author defines ground water hydrology as "the science of the occurrence distribution and movement of water below the surface of the earth." He first outlines the uses and the importance of ground water in the water supplies of various states. Ground water supplies as little as 4 percent of the water in some eastern states and 76 percent of South Dakota's water. Almost three-quarters of ground water use is for irrigation.

Next the author covers the occurrence and movement of ground water; definitions of water under the ground surface and basic information on rock porosity. Ground water characteristics of 24 major basins in the United States are briefly described. Aquifers and their yields, springs, and ground water flow are discussed. The basic physics and the practical considerations and limits receive equal treatment. We learn that porosity in natural aquifers ranges from 16 to 45 percent, and that flow in these aquifers varies by a factor of nearly 500, with the normal range of flow varying from 5 feet per year to 5 feet per day.

Water wells and well hydraulics come next. The construction and testing of wells is rather thoroughly discussed and illustrated. Not many of us will dig a well but any of us can contaminate one. The role of wells in percolation from surface waters will interest surface water hydrologists.

A chapter on ground water fluctuation sounds like a dull topic, but certainly is far from that. Everything causes ground water fluctuations—from such remote influences as moonrise and distant earthquakes to local influences of a passing train, a hurricane, and transpiration by vegetation. Want your own seismograph? Dig a well.

The chapter on ground water quality is more than this, for it includes not only sources of variation in quality, but criteria of tolerances of various crops, industrial, and human uses as well as problems of irrigation practices, return flow, and water temperature. Do you want to know the mean annual temperature for any place in the world? Don't set up a weather shelter and take 50 years of records—simply subtract 2° F. from the ground water temperature at 30 feet depth.

Next the author discusses basin-wide development of ground water. Methods of estimating the "safe yield" are demonstrated. It appears there is no simple answer to planning conjunctive use of streamflow and ground water for a water supply of an area. Conjunctive use evaluation requires careful analysis of water supplied to the basin and of the present and future water requirements. It also requires knowledge of the overlying soil and the underlying geology of the basin and its aquifers. For a solution—hire the best engineering consultant firm that you can afford.

The surface location of ground water and subsurface appraisal of ground water aquifers are outlined—sonic, gravimetric, magnetic, and electrical methods get short discussions. Dowsing or "water witching" is one subject that the author does not try to digest for you; he covers this controversial subject largely by quotations of other authorities. After the well is dug, then analysis of the quality of the water at various levels indicates the principal water yielding layers, sources of saline water and, most important, a measure of the yield to be expected.

Artificial recharge of ground water basins by spreading of surface waters, by well pumping near rivers, and by filter basins distant from the intake are sketched and their operation discussed.

The book ends with short chapters on the hydraulics of sea water intrusions into fresh water basins, and of legal problems of ground water use and some of their solutions. The use of models, electrical analogues, and numerical analysis in laboratory studies of ground water problems is outlined. An appendix of constants and conversion factors useful in ground water hydrology and a subject index complete the book.

Here is a modern book covering a field of hydrology where the product is mostly unseen—buried beneath the earth. Yet much has been discovered.

This reviewer concluded that we know more about the physics of ground water and the distant stars than we know about the physics of surface water and the shape of our own earth. Apparently we need only make it difficult for man to learn and he will find ways to learn. To learn more about surface hydrology should we hire blind hydrologists? Maybe they would

learn how to express topography and soils and forests so as to predict their effects on surface waters-streamflow and floods.

Todd's *Ground Water Hydrology* is good reading and is a fine reference for the soil scientist, the engineer, or the forester.

H. W. ANDERSON
Snow Research Leader
Pacific Southwest Forest and Range Experiment Station

Forest Trees and Timber of New Zealand

By H. V. Hinds and J. S. Reid under the direction of Alex. R. Entrican. 211 pp. Illus. R. E. Owen, Government Printer, Wellington, New Zealand. 1957. 17s. 6d.

Designed primarily for foresters, sawmillers, and those connected with the wood-using industries, *Forest Trees and Timbers of New Zealand* presents a concise summary of the major trees and timber of New Zealand. For each of the 29 principal species of the country (including 19 indigenous and 10 exotic), an average of 6 pages is devoted to its forestry significance, identification, distribution, silviculture, protection, and the economics, properties, and uses of its timber. Distribution maps of indigenous species are included as well as two insert maps showing the state exotic forests. These data, together with an opening chapter summarizing the climate, soils, native vegetation, history of introduction of exotic species, and forest utilization, make it an up-to-date and important reference on the forestry and tree species of this country.

Of the native forest trees, kauri is the most interesting, but the podocarps (including rimu, the most abundant native tree) and the southern beeches of the genus Nothofagus are the most important today. Largely since 1920, however, about 900,000 acres have been planted to introduced species, with the result that half the present timber cut now comes from this group. Monterey pine (called radiata pine in New Zealand) occupies more than 60 percent of the planted area and accounts for 95 percent of the cut of exotic species being used for pulp, paper, wallboard and cardboard as well as for lumber. Ponderosa pine occupies about one-tenth of the planted area, followed by Corsican pine with 60,000 acres, Douglas-fir with 45,000 and lodgepole pine with 20,000.

On good quality sites in northern New Zealand, Monterey pine will reach a height of 130 to 140 feet by the end of a 40-year rotation, producing from 8,000 to 10,000 cubic feet per acre of sawlogs. Wood quality has been fairly satisfactory but far poorer than would have resulted had pruning and thinning been practiced more widely.

Since American species are of primary importance to New Zealand foresters, the data presented will be of interest to American foresters. Since much of the forestry terminology and procedures are familiar, the book fortunately will be quite comprehensible to them.

STEPHEN H. SPURR
School of Natural Resources, The University of Michigan

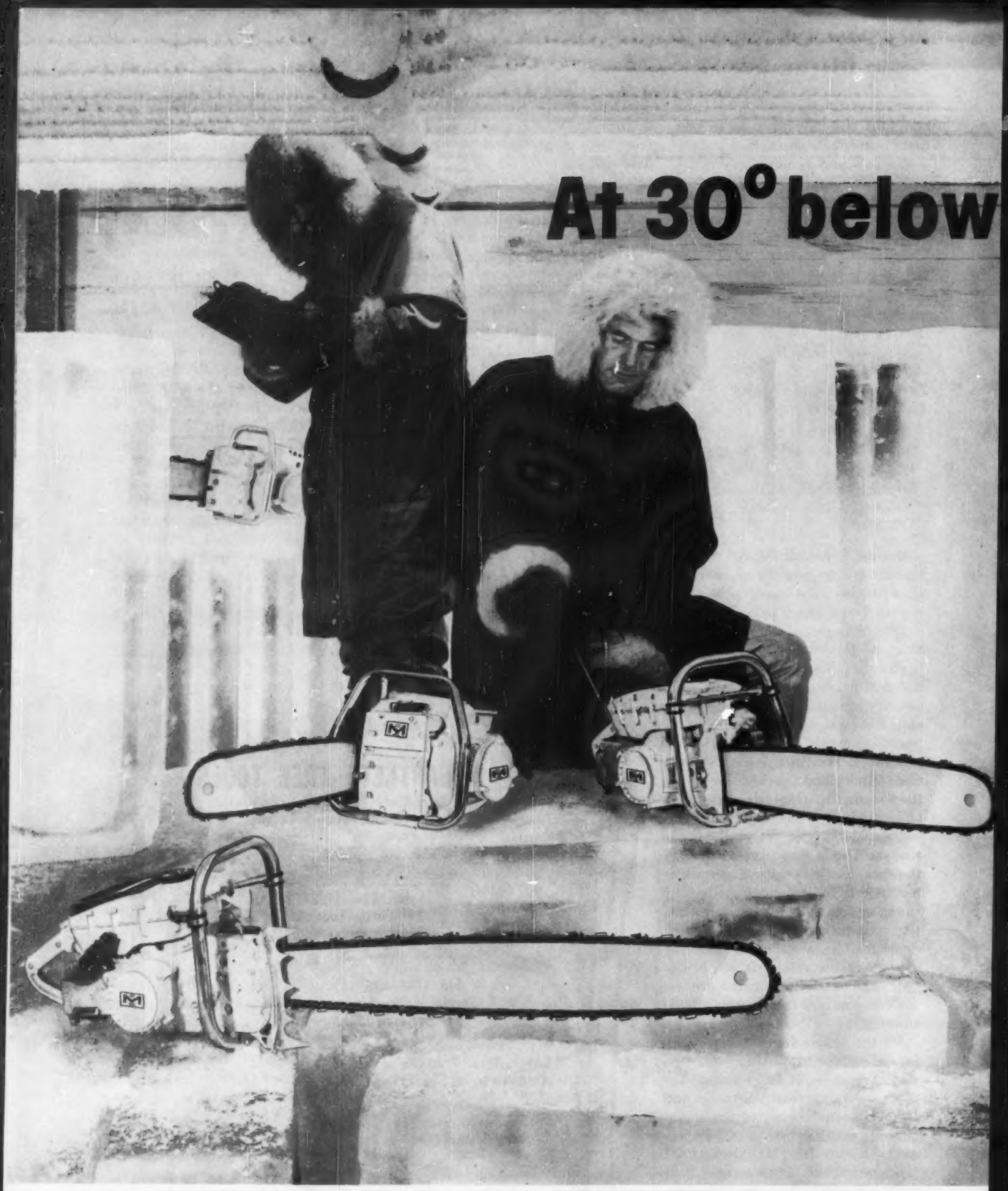
Living Earth

By Peter Farb. 167 pp. Harper & Brothers, New York. 1959. $3.75.

Author Farb, noted science writer, has produced an interesting and readable, yet scientifically accurate discussion of life in the soil, showing how countless billions of organisms that live in the topsoil make it "alive," and indirectly, how they aid soil conservation.

"Earth is not soil unless it is inhabited," Farb says as he describes how the plants, animals, bacteria, insects, and fungi add fertility to the soil as they compete and cooperate in a never-ending struggle for life.

He tells of slime molds, naked



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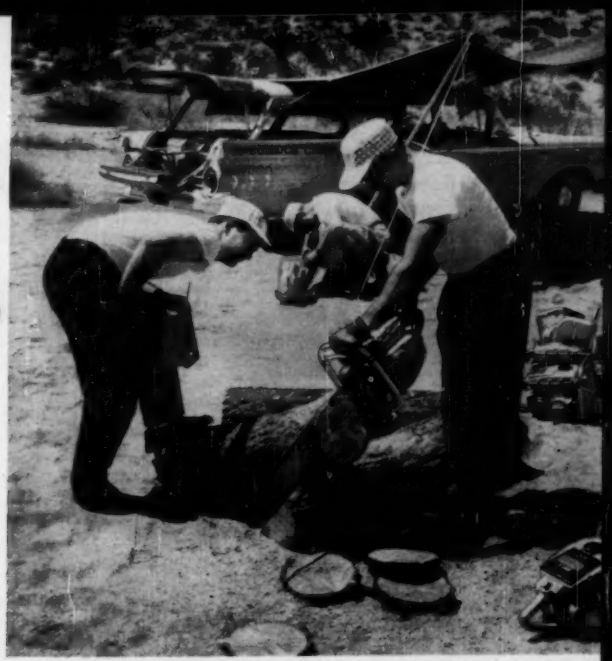

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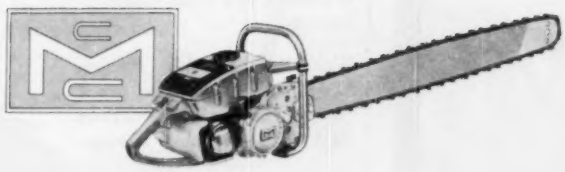

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masses of photoplasm which reproduce by spores; mycorrhizal root systems, in which fungi process nutrients for tree roots; ants which raise fungus crops; wasps that paralyze tarantulas to provide food for their own young; and many other stories which illustrate the complexity of soil life.

Although forest, grassland, and desert soils are discussed separately, the text is integrated into a well-organized whole, partly by covering organisms common to all three soil types.

The material can easily be understood by people with no background in soil science. The book is valuable supplementary reading for students of high school age and up.

Because it is both interesting and accurate, high school science and biology teachers will find the book useful in their classes.

C. W. MATTISON
Conservation Education Association

Publications of Interest

The story of modern forestry, from the time that the seed is collected and planted to the time when the log is dumped into the river, is dramatized in a new film, *Tomorrow's Trees*, by the Weyerhaeuser Company. The film is available for showing to local groups.

The color film shows aerial seeding by helicopter and then follows by time lapse views of a seedling as it first breaks from the soil as well as terminal growth of the older seedlings. It carries on through the growth and management of the forest with some excellent shots of falling timber, topping the spar tree, and the various phases of logging.

* * *

Men of Timber, Volume III, a tribute to those men who have served as president of the Pacific Logging Congress during its first 50 years, was distributed to delegates to the Golden Anniversary session at Seattle, Wash., November 11-15, 1959.

Published by Caterpillar Tractor Co. as a service to the logging industry, the book contains biographies and portraits of each of the 37 past presidents of the Congress. Volumes I and II were published by Caterpillar in 1954 and 1955.

* * *

The Oregon Forest Lands Research Center is beginning publication of a new series: *Studies of Oregon's Climate for the Forest Industry*. These studies will present weather data from the past decade or more in a form which is useful in answering many operational questions of the forest industry.

Requests for the publication should be mailed to: "Studies of Oregon's Climate," Oregon Forest Lands Research Center, P. O. Box 571, Corvallis, Ore.

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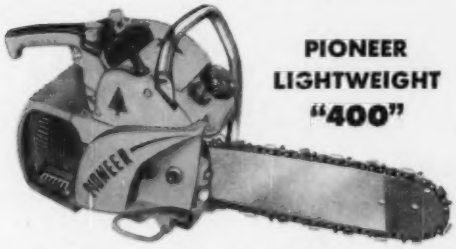

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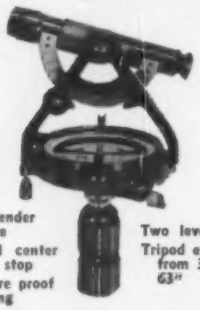

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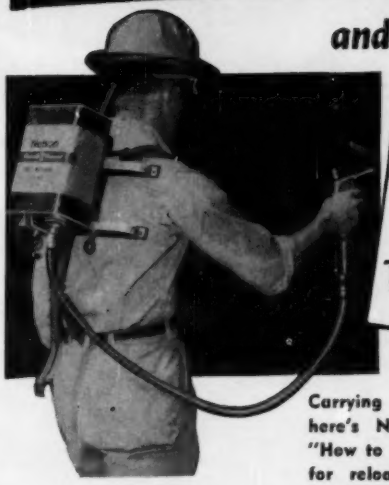

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Coming Events

Southeastern Section

Annual meeting in Valdosta, Ga., January 28-29, 1960.

Allegheny Section

Morgantown, W. Va., February 11-13, 1960. Theme: "Professional Growth—A Positive Approach."

Ozark Section

Winter meeting in Little Rock, Ark., February 12 and 13, 1960.

Appalachian Section

Winter meeting in Durham, N. C., February 12-13, 1960.

New England Section

The New England Section will hold its meeting at the Statler-Hilton Hotel, Boston, Mass., March 17 and 18, 1960.

Pisgah Chapter Formed in North Carolina

The sixth and newest Chapter of the Appalachian Section has been authorized as the Pisgah Chapter in western North Carolina. Formal presentation of the Charter will be made at the annual meeting of the Appalachian Section to be held in Durham, N. C., February 12-13, 1960. This is the first Chapter to be formed in North Carolina. There are two Chapters in Virginia and three in South Carolina.

Officers of the Pisgah Chapter are: W. E. Howell, chairman; E. L. Demmon, vice chairman; and H. J. Boger, secretary treasurer.

The Pisgah Chapter territory lies in western North Carolina west of a line between Forest City and Boone. SAF members living in this area are invited to participate in the Chapter's activities.

Robert H. K. Phipps (1906-1959)

Robert H. K. Phipps, Coos County forester since 1942, died of a heart attack at his home, Gorham, N. H., November 19.

He received a B.S. degree in forestry in 1931 at the University of New Hampshire, and subsequently worked for the U. S. Forest Service six years as a cultural foreman at a CCC Camp on the White Mountain National Forest.

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You should also notify your local post office on postal form number POD 3575 of your change of address. Both postal forms are obtainable at any post office.

Copies of the JOURNAL will not be forwarded by the Post Office Department. Hence, in order to avoid missing your copy as well as to prevent extra expense to the Society in supplying duplicates, you are urged to notify the JOURNAL as soon as you know your new address, a month in advance of change if possible.

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Washington 6, D. C.

During the time he had been county forester he earned the respect of the farmers, other small woodland owners, and the representatives of the forest industry. Besides his assignment of advising and assisting woodland owners in improved management and marketing practices, it was largely his efforts that encouraged the Christmas tree growers of the region to organize the New Hampshire-Vermont Christmas Tree Growers' Association.

He was co-author of Extension Bulletin 140 "Christmas Trees—A Cash Crop." More than 2,000 acres of cropland in Coos County are being planted to trees under the provisions of the Soil Bank Program. He had the job of assisting the landowners in getting the plantations established.

Roy A. Chapman (1902-1959)

Roy A. Chapman of Arlington, Va., forester-statistician in the Division of Forest Economics Research, U. S. Forest Service, Washington, D. C., died of a heart attack on November 27.

Born in Sycamore, Ill., December 25, 1902, Mr. Chapman was graduated in 1927 in forestry at the University of Minnesota. Subsequently, he studied mathematics and statistics at George Washington University and the U. S. Department of Agriculture Graduate School.

His entire career was spent in the Forest Service, which he entered in 1927 at the Northeastern Forest Experiment Station. For 18 years he was with the Southern Forest Experiment Station, where he became a well-known specialist in statistical analysis and mensuration. During the past 12 years he was in the Washington, D. C. office, Branch of Research.

Mr. Chapman was the author and co-author of numerous articles and bulletins on forest measurements, and was a contributor to the JOURNAL OF FORESTRY. He was a member of the SAF editorial committee that supervised the production of the *Forestry Handbook* published in 1955.

Membership Applications and Advancements

Proposals for admission, advancement, and reinstatement received in the Society office during the month of November are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of January 1960.

Communications from the voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Alaska Section

Junior Grade

Beckman, G. M., Forester, Kasaan Ranger Dist., Ketchikan, Alaska. Mont. State, BSF, 1958.

Allegheny Section

Student Grade

PENNSYLVANIA STATE UNIVERSITY

Cunningham, H.
Dinus, R. J.
Downing, D. A.
Forney, R. T.
Heroux, J. B.
Perry, R. J.
Stauffer, W. K.

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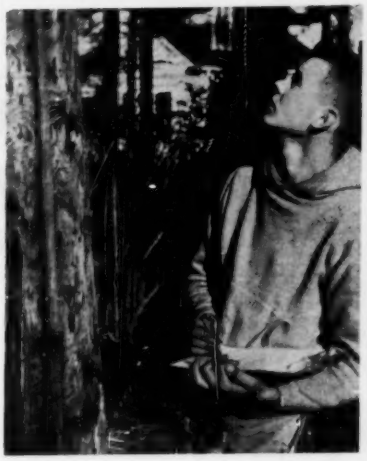

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Adams, E. L.
Antill, R. G.
Bailey, F. E.
Brown, E. B.
Cones, W. L.
Cromer, J. I.
Foreback, C. G.
Frame, E. D.
Gillespie, J. L.
Grafton, A. E.
Grafton, Wm. N.
Gregory, H. D.
Jones, L. T.
Luzadder, H. R.
Mitten, G. P.
Price, J. D.
Rensma, S. E.
Rexrode, C. O.
Roth, E. E.
Ruddle, M. D.
Smith, B. L.
Smith, H. C.
Smith, R. C.
Thayer, J. M.
Thomas, C. L.

Junior Grade

Jordan, J. S., Research Forester, USFS, Warren, Pa. Univ. Mich., BSF, 1946.

Neely, O. O., Forester, Tillinghast & Reed, Danville, W. Va. (Reinstatement).

Member Grade

Broshkevitch, J. B., Supt., Parvin State Park, Elmer, N. J. Univ. Maine, BSF, 1954. (Junior 1954).

Appalachian Section

Student Grade

NORTH CAROLINA STATE COLLEGE

Baker, J. O.
Barnard, P. W.
Beaver, J. L.
Boyette, A. C.
Bradley, E. W.
Bray, W. T.
Brill, R. B.
Butler, R. M.
Byrd, W. B.
Cunningham, H. C.
Dabney, W. R.
Eckstein, L. W.
Godwin, T. H.
Grimsley, D. L.
Gurganus, C. M.
Hamme, J. C.
Hamrick, B. W.
Harrill, T. L.
Keaton, P. N.
Lanston, E. H.
Lockwood, J. N.
MacDonald, R. D.
Mace, S. V.
McPherson, J. P.
Miller, R. W.
O'Quinn, C. N.
Pridgen, J. P.
Scheurenbrand, H. J.
Shuford, W. B.
Turner, J. H.
Walters, J.
Watson, C. W.
Williams, J. R.
Wolfe, J. D.
Young, D. G.

Junior Grade

Augsburger, G. W., Forester, Va. Div. of Forestry, Sandston, Va.

Hudgens, T. A., Commercial Foresters, Inc., Asheville, N. C. (Reinstatement).

Kidd, W. E., Service Forester, Va. Div. of Forestry, Salem, Va. (Affiliate 1957).

Member Grade

Penny, W. R., Research Forester, W. Va. Pulp & Paper Co., Ivy, Va. Univ. Mich., BSF, 1956. (Junior 1956).

Affiliate Grade

Kayll, A. J., Grad. Student, Duke Univ., Durham, N. C.

Central Rocky Mountain Section

Member Grade

Bucknam, R. F., Area Forester, Bur. of Land Mgmt., Denver, Colo. (Reinstatement).

Central States Section

Student Grade

PURDUE UNIVERSITY

Corcoran, T. J.
VanEmon, P. J.
Wright, C. L.

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Arundell, D. L.
Carlson, J. P.
Mohr, D. D.
Ramsing, K. D.
Weaver, F. C.

Junior Grade

Downhill, O. W., Forester, USFS, Roseburg, Ore. Univ. Mass., BSF, 1958, Duke Univ., MF, 1959.

Mezger, W. L., Dist. Forester, Weyerhaeuser Co., Longview, Wash. (Affiliate 1953).

Member Grade

Holloter, G. C., Forester, USFS, Parkdale, Ore. Ore. State College, BSF, 1954. (Junior 1954).

Gulf States Section

Student Grade

LOUISIANA STATE UNIVERSITY

Bankston, J. R.
Fowler, J. E.
Penny, J. W.
Sullivan, A. C.
Whitehead, G. W.

Junior Grade

Chenevert, R. L., Forester, Farmcraft Assoc., Inc., Alexandria, La. La. State Univ., BSF, 1954.

Inland Empire Section

Student Grade

UNIVERSITY OF IDAHO

Adams, D. L.
Emmingham, W. H.
Kipp, H. W.
Sharpnack, D. A.

Junior Grade

Huffman, P. W., Forest Inventory Supv., Potlatch Forests, Inc., Lewiston, Idaho. (Reinstatement).

Intermountain Section

Student Grade

UTAH STATE UNIVERSITY

Belanger, R. P.
Hayes, H. W.

Junior Grade

LeDosquet, R. H., Forester, Bur. of Land Mgmt., Burley, Idaho. Utah State, BSF, 1950.

Kentucky-Tennessee Section

Junior Grade

Student Eligible for Automatic Advancement

NORTH CAROLINA STATE COLLEGE

Zoochi, J. L.

New England Section

Student Grade

UNIVERSITY OF MAINE

Brown, M. F.
Cross, P. W.
Goody, J. R.
Morrill, A. A.
Safford, L. O.
Shumway, R. S.
Small, G. H.
Stuart, G. W.
Taber, D. W.

YALE UNIVERSITY

Ellis, T. H.
Langham, C. M.
Larson, L. K.
Slade, R. G.
Thurston, E. A.
Winkworth, A. V.

Junior Grade

Donnelly, R. H., Student, Yale School of Forestry, New Haven, Conn. Univ. Wash., BSF, 1956.

Northern California Section

Student Grade

UNIVERSITY OF CALIFORNIA

Lanier, G. N. Lauderdale, K. R.

Junior Grade

Eisenman, H. J., Jr. Forester, Klamath Natl. Forest, Yreka, Calif. N. Y. State, BSF, 1956.

Peterson, W. A., Forest Supv., USFS, Quincy, Calif. (Reinstatement).

Member Grade

Morrett, C. M., Jr. Tbr. Appraiser, Mendocino Co. Assessor's Office, Ukiah, Calif. (Junior 1952).

Affiliate Grade

Ward, W. H., TSI Asst., Mendocino Natl. Forest, Willows, Calif.

Zimmerman, E. D., Supt. of Logging, International Paper Co., Weed, Calif.

Northern Rocky Mountain Section

Student Grade

MONTANA STATE UNIVERSITY

Abbott, R. W. Haiges, M. L.
Appel, R. O. Heiser, D. A.
Black, R. L. Jacobson, J. A.
Carr, W. R. Jenni, D. R.
Colgan, D. L. Lawrence, T. W.
DeBruin, E. H. Lindh, C. J.
Dieter, R. T. Miller, R. H.
Elliott, J. W. Moorhouse, J. A.
Greenwald, W. F. Travers, C. M.
Wallrich, J. M.

Junior Grade

Gerlach, F. L., Instructor in Forestry, Mont. State Univ., Missoula, Mont. Mont. State BSF, 1952, MF, 1957.

Hauer, J. W., Asst. Dist. Ranger, USFS, Kalispell, Mont. (Reinstatement).

Howard, H. R., Forester, USFS, Kalispell, Mont. (Reinstatement).

Affiliate Grade

Wheeler, E. E., Forester, Libby Ranger Station, Libby, Mont.

Ozark Section

Affiliate Grade

Mann, W. B., Asst. Dist. Forester, Dierks Foresta Inc., Hot Springs, Ark.

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Davis, J. M. Green, O. N.
Dugas, F. A. Johnson, B. L.

Affiliate Grade

Overstreet, R. B., Asst. Inventory Forester, Scott Paper Co., Everett, Wash.

Southeastern Section

Student Grade

UNIVERSITY OF FLORIDA

Morse, T. A.

UNIVERSITY OF GEORGIA

Dekle, J. G. Pittman, J. D.
Hinson, J. W. Steinbeck, K.
Lamb, C. B. Tatum, W. J.
Lowe, C. A. Todd, J. J.
Waters, T. A.

Junior Grade

Bailiff, T. C., Sr. Forester, Ga. Kraft Co., Talbotton, Ga. (Reinstatement).

Foulger, A. N., Research Forester, Union Bag-Camp Corp., Savannah, Ga. Univ. Mich., MF, 1959.

Sharp, J. D., 708 Tippins St., Baxley, Ga. (Reinstatement).

Student Eligible for Automatic Advancement

ALABAMA POLYTECHNIC INSTITUTE

Helms, J. A.

Southern California Section

Junior Grade

Taylor, T. I., Asst. Forest Engr., USFS, Pasadena, Calif. Mich. College Mining and Tech., BSF, 1947.

Upper Mississippi Valley Section

Student Grade

IOWA STATE UNIVERSITY

Brinck, R. P. Kaderabek, J. K.
Cochran, P. H. Kocina, K. R.
Doolittle, R. C. Sieverding, T. V.
Howells, B. D. Whitmore, R. E.
Zimmer, M. J.

UNIVERSITY OF MINNESOTA

Benson, M. K. Larson, R. G.
Brown, J. K. LeBarron, W. W.
Churchill, G. B. Lee, N. R.
Cottrell, H. C. Lindell, G. R.
Eckstein, C. W. Lindmark, R. D.
Ellefson, P. V. Morton, H. L.
Ferweda, C. E. Pearson, G. C.
Grafstrom, M. D. Pederson, R. M.
Haasl, G. R. Probasco, J. M.
Hayden, M. S. Salomonsen, F. E.
Hilliker, R. L. Smith, P. F.
Illi, W. A. Stout, B. E.
Kiefer, W. D. Sudheimer, L. C.

Junior Grade

Frudden, C. M., Owner, Frudden Bridge Lbr. & Supply Co., Greene, Iowa. Univ. Minn., BSF, 1920.

Witmer, C. R., Dist. Forester, Iowa Cons. Comm., Chariton, Iowa. Iowa State, BSF, 1940.

Affiliate Grade

Montgomery, L. C., Forestry Aide, USFS, Blackduck, Minn.

Wisconsin-Michigan Section

Affiliate Grade

Peterson, E. L., Partner, Peterson Bros. Co., Carney, Mich.

Peterson V. C., Partner, Peterson Bros. Co., Carney, Mich.

No Section

Corresponding Grade

Barcelo, Antonio-Luis Suau, Forest Engr., Dept. of Agric., Madrid, Spain.

Martinez, Carlos Fernandez-Martos, Ingeniero de Montes, Jefe de la Tercera Seccion del Distrito Forestal de Valencia, Ministerio de Agricultura, Madrid, Spain.

Naraballobh, V., Head of the Forest Mgmt. Dept., Kasetsart Univ., Bangkok, Thailand.

Perez, Manuel Alvarez-De-Mon, Forestry Eng., Santander Forestry Dist., Madrid, Spain.

Rico, Filiberto Rico, Jefe de Seccion en el Servicio de la Madera, Servicio de la Madera, Madrid, Spain.

Salti, J., Director of Forests, Ministry of Agric., Amman, Jordan.

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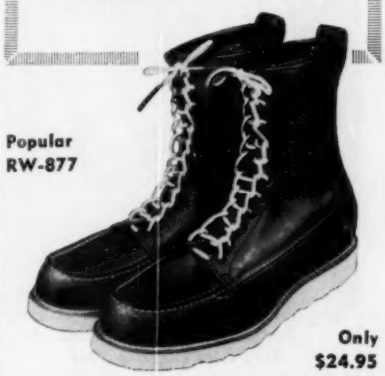

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Forestry News

FAO Establishes North American Forestry Commission

Delegates from the United States, Canada and Mexico attending the Ninth Session of the FAO Conference in Rome announced the formation of an FAO North American Forestry Commission. This is the fifth regional forestry commission so far established by FAO. The other forestry commissions are the Latin American, established at Teresopolis, Brazil in 1948; the European at Geneva in 1949; the Asia-Pacific at Bangkok in 1950; and the Near East at Teheran in 1955.

The commissions are composed of government representatives functioning at the policy level, while their subordinate committees, working parties and other organs operate on the technical level.

The commissions are concerned with long-range forest improvement and the development of sound silvicultural practices and techniques and provide a forum where interested governments may consider problems of a regional character. They are expected not only to give guidance to the Director-General but also to formulate recommendations on such matters as may require coordination of national policies. Establishment of these forestry commissions reflects FAO's policy to organize its activities to an increasing degree on a regional basis, taking into account the wide differences that exist between regions with respect to resources, soil, climate and cultural traditions, as well as the methods for solving problems.

C.I.F. Names New President

Hugh J. Hodgins, vice president, timber, Crown Zellerbach Canada Limited, has been elected president of the Canadian Institute of Forestry according to a recent announcement of the Institute. Mr. Lowell Besley, chairman, Woodlands Research Department, Pulp & Paper Research Institute of Canada, was elected vice president.

Mr. Hodgins has had a prominent career in Canadian forestry, having gained wide experience with government and industry and as a consulting forester.

He is the immediate past president of the Canadian Forestry Association, B. C. Division, a charter member of the Association of B. C. Foresters, and first vice president of the Western Forestry & Conservation Conference. During the hearings of the Royal Commissions on Forestry conducted by the late Chief Justice Gordon Sloan, in 1944-1945 and 1955-1956, Mr. Hodgins was retained as an observer for some of the largest forest operators in B. C. and, during the latter Royal Commission, was forest counsel for Crown Zellerbach Canada Limited.

Mr. Hodgins will hold office as president of the Canadian Institute of Forestry for a two-year term.

1958 Lumber Exports Down from 1957

Lumber exports from the United States in 1958 totaled 728.2 million board feet, a decline of about 10 percent from shipments of 811.4 million board feet in 1957, the Forest Products Division, Business and Defense Services Administration, U. S. Department of Commerce, reported recently.

In a publication, *United States Lumber Exports,* 1958, the Division said that the decline was largely in softwood shipments, which represented nearly 75 percent of total lumber exports. Only 540.4 million board feet of softwood lumber was exported in 1958, compared with 614.5 million feet in 1957. Shipments of Douglas-Fir declined nearly 32 percent from

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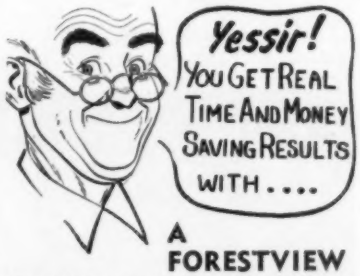

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1957 and southern pine dropped 14.5 percent. These declines were partially offset by increases in other species of softwood, which totaled 224.3 million board feet in 1958, an increase of 29.4 percent above 1957.

Hardwood lumber exports showed little change in 1958, amounting to 98.3 million board feet, compared with 98.4 million feet in 1957. Railroad crossties dropped below the 1957 level, from 68.8 million feet in 1957 to 53.2 million feet in 1958.

Hardwood flooring exports continued an upward trend, rising to 26.1 million board feet, an increase of 37.2 percent above 1957.

Of the countries receiving the major share of U. S. exports, only Canada, West Germany, Venezuela, and Italy increased their purchases in 1958. Shipments to Canada increased 10 percent over 1957, reaching 262.1 million board feet. This represented 36 percent of total U. S. lumber exports.

Exports to other countries decreased sharply. Australia took only 60.1 million board feet in 1958, compared with 78.0 million in 1957. Decreases from 1957 also occurred in shipments to Korea, the Union of South Africa, Japan, the United Kingdom, and Cuba.

Stamp to Commemorate Forestry Congress

Postmaster General Arthur E. Summerfield has announced that a United States commemorative postage stamp honoring the Fifth World Forestry Congress, the first ever held in the United States, or in the Western Hemisphere, will be issued on August 29, 1960, the opening day of the Congress, in Seattle, Wash.

The Post Office Department has issued in recent years four wildlife conservation stamps featuring the pronghorn antelope, the wild turkey, the whooping crane, and the king salmon as well as stamps honoring forest conservation and soil conservation. This series of conservation stamps will be continued in 1960 by issuing a water conservation stamp on April 18, 1960, on the occasion of the Seventh National Watershed Congress in Washington, D. C.

Stamp Cancellation Features Tahoe Forest, Winter Olympics

The Post Office Department and the U. S. Department of Agriculture are cooperating in stimulating interest in winter sports in the national forests through a special postal slogan cancellation authorized in connection with the Winter Olympic Games to be held in Squaw Valley in the Tahoe National Forest of California. First and second class post offices now may request this cancellation for first class mail: "1960 Winter Olympics, Tahoe National Forest, California." The Olympics are being held on national forest land under a special use permit issued by the Forest Service. Beginning on February 18, some 1,000 athletes from 35 nations are expected to compete in the Winter Olympics at Squaw Valley. A commemorative U.S. postage stamp honoring the games will be issued about the same time.

Private & Industrial

NLMA Meets

Action to improve the fortunes of the lumber industry on several fronts was taken at the 1959 annual meeting of the National Lumber Manufacturers Association, November 9-12 in Washington, D. C. The meeting involved sessions of the NLMA board of directors, the lumber industry's National Wood Promotion Committee and the National Wood Council.

NLMA directors moved to increase public acceptance and understanding of lumber industry grade marks and acted to strengthen the domestic lumber industry against foreign competition.

On the forestry front, the association's governing body urged that in establishing programs for management of federally owned commercial forest land, priority be given to programs and activities to put the administration of such lands on an "income-producing and pay-as-you-go basis." The NLMA board also urged the Forest Industries Council, policy co-

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ordinating body of the lumber, pulp and paper industries, to seek elimination of waste and duplication in federal aid programs for small woodlot owners. In other resolutions, NLMA directors:

(1) Asked NLMA's 17 federated associations to provide the U. S. Forest Products Laboratory with detailed information on the market potential for glues in the lumber industry. (2) Called for immediate preparation of a handbook or design manual on industrial use of lumber, responsible for about one-third of present lumber output. (3) Ordered an intensification of NLMA efforts to publicize career opportunities in the private forest industries. (4) Called for legislation to eliminate false labeling and false advertising of imitation wood products and urged that the Federal Trade Commission be given jurisdiction over "deceptive sale of such products at the retail level" when interstate shipment is involved.

Thomas J. McHugh of the Atlantic Lumber Co. was elected NLMA president for 1960, succeeding Robert M. Ingram of the E. C. Miller Cedar Lumber Co., Aberdeen, Wash. Ingram was elected NLMA board chairman, succeeding N. Floyd McGowin of the W. T. Smith Lumber Co., Chapman, Ala., who becomes chairman of the association's Policy Committee. A. B. Hood of the Ralph L. Smith Lumber Co., Anderson, Calif., was named first vice president.

M. L. Fleishel of Jacksonville, Fla., Mortimer B. Doyle of Washington, D. C., and Henry Bahr, also of Washington, were re-elected treasurer, executive vice president, and secretary, respectively.

Women to Get Story of Tree Farm Values

To work closely with women's groups in matters of forest conservation as embraced in the multiple-use concept of tree farming, American Forest Products Industries announces the formation of a Women's Affairs Division headed by a former WAVE officer.

Mrs. Rosalie M. Koch of Arlington, Va., director of the new AFPI division, will head the program.

Mrs. Koch served on active duty with the U. S. Navy from 1943 until July 1958, receiving permanent promotion to the grade of lieutenant commander in 1951. After assignments in personnel, training and public information, she became reserve editor of the *Naval Aviation News* magazine

MRS. ROSALIE M. KOCH

Later, she was appointed head of WAVE procurement and directed nationwide programs for the recruitment of WAVE officer candidates and enlisted personnel. Following this, she served as information analyst and women's affairs officer in the Office of the Chief of Naval Operations in Washington, D. C.

After leaving the Navy, Mrs. Koch joined the American National Red Cross as chief of the magazine section in the Office of Public Information.

Heacox Named Divisional Vice President for Weyerhaeuser Timberland Division

Changes in Weyerhaeuser Companys top organizational structure include the appointment of five new divisional vice presidents, according to President F. K. Weyerhaeuser. One of these posts is as head of the timberland division.

Corporate Vice President George Weyerhaeuser heads the renamed lumber, plywood, and timberland group which will include the lumber and plywood division and the timberland division. Vice presidents are John R. Titcomb, manufacturing; Robert S. Douglas, marketing; Edwin F. Heacox, timberland division.

Corporate Vice President John Aram of the research, new products, and Silvatek group, directs the activities of three divisions.

Operations of the pulp, paperboard, and container group under Corporate Vice President Howard W. Morgan, have been reorganized into four divisions.

J. H. Hinman New President AFPI

John H. Hinman, chairman of the board of International Paper Co., New York, was elected 1960 president of American Forest Products Industries.

W. R. Adams, St. Regis Paper Co., New York, was elected a vice president. J. D. Bronson, Cascade Lumber Co., Yakima, Wash., was re-elected a vice president. D. B. Frampton of the D. B. Frampton & Co., Columbus, Ohio, was re-elected treasurer. Charles A. Gillett of Washington, D. C., was renamed managing director.

Crown Zellerbach Foresters Promoted

J. P. Johnston, contract logging supervisor at Crown Zellerbach's Clackamas Tree Farm near Molalla, Ore., has been promoted to the post of protection forester for the corporation's Washington and Oregon timber divisions.

W. E. O'Dea, construction foreman at the company's Brightwood, Ore., operation, will succeed Johnston as Clackamas contract logging supervisor.

Johnston attended the University of Washington, receiving his master's degree from the school's college of forestry following service with the U. S. Navy in World War II. He worked as a forester for the J. Neils Lumber Co. in South Central Washington and was associated with SHADA, a U. S. economic aid and education program in Haiti from 1948 until 1953. During his Caribbean tour, Johnston was a divisional manager in the forest section, later heading the timber unit as principal forester. He joined Crown Zellerbach in April, 1954 at the Clackamas Tree Farm as a forester and was promoted to contract logging supervisor in July, 1955.

Working from the Portland timber department office, Johnston will coordinate fire suppression and forest

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PHILLIP G. ANNAND

regeneration activities on the company's 12 Northwest tree farms.

O'Dea, also a University of Washington forestry graduate, served several years with the U. S. Forest Service and later was employed as a forester by Rayonier, Inc. and Long Bell Lumber Co. He served as lieutenant in the Navy during World War II. He joined Crown Zellerbach in November, 1948 and previously was construction foreman at the company's Clatsop and Clackamas divisions before the Brightwood assignment.

Watershed Association Names Director

Paul M. Felton has recently accepted the position of executive director of the Wissahickon Valley Watershed Association, Inc., Fort Washington, Pa.

This organization is both educational and promotional in nature with plans to develop the 53 square mile drainage of the Wissahickon Creek Valley into a model watershed.

New Western Pine Forester Named for Southwest

Phillip G. Annand, formerly with Diamond National Corp. at Stirling City, Calif., has been named Southwest district forest engineer by the Western Pine association. He replaces Arthur T. Upson, of Tucson, Ariz., who retired recently.

In announcing the appointment, chief forester E. L. Kolbe, Portland, Ore., said Annand will make his home in Albuquerque, N. Mex., and will serve the lumber industry of Arizona, New Mexico, Colorado, Wyoming, Utah, and the Black Hills of South Dakota on timber matters, forest practices, tree farm management, and forest protection problems.

Annand, a veteran of the Korean War, is a University of California forestry graduate with an M.S. from Yale. He was assistant resident forester at Stirling City for the Diamond operations.

AFPI Information Director Named

American Forest Products Industries recently announced the promotion of Ben G. Rhodes to the newly created position of director of public information.

A former West Virginia newsman and journalism graduate of West Virginia University, Rhodes joined AFPI in 1951 as district manager of a four-state office at Huntington. Since February, 1956, he has been serving as administrative assistant to managing director Charles A. Gillett.

In addition to administrative duties, Rhodes will supervise AFPI's nationwide field organization through 14 district offices.

Schools

Third Annual Kiln-Drying Short Course to Be Held at the University of Illinois

K. R. Peterson, wood technologist at the University of Illinois, announces that the Department of Forestry, University of Illinois College of Agriculture, will act as host for the 1960 Kiln-Drying Short Course, Mar. 21-25, conducted cooperatively with the following agencies: Delmhorst Instrument Company, Foxboro Company, Iowa State University, Lumber Drying Specialty Company, Michigan State University, Moore Dry Kiln Company, Purdue University, Standard Dry Kiln Company, Southern

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For further information about the short course, write to: Kiln-Drying Short Course, Department of Forestry, 219 Mumford Hall, Urbana, Ill.

S. H. Spurr Receives Grant for New Zealand Study

Stephen H. Spurr, professor of silviculture at The University of Michigan, has received a Fulbright grant to conduct research next year at New Zealand's Forest Research Institute, Rotorua.

A specialist in the mathematical approach to forest environment and distribution, Dr. Spurr will investigate the influence of New Zealand soils and climate on the growth of American tree species planted there, specifically the Monterey pine and Douglas-Fir. He will leave the university about February 1 and return September 15, 1960.

Editor of *Forest Science* since its initiation in 1955, Dr. Spurr has studied forest ecology in several countries of Western Europe and two years ago was awarded a National Science Foundation science-faculty fellowship to conduct research at the University of California, Berkeley.

Forestry Symposium at LSU Scheduled for April

Louisiana State University's ninth annual Forestry Symposium will be held April 6-7, 1960.

Topic for the two-day meeting is "The Use of Chemicals in Southern Forests." The discussion will include chemical usage in forest protection as well as fertilization and herbicides.

Inquiries should be addressed to Professor Robert W. McDermid, general chairman, LSU School of Forestry, Baton Rouge 3, La.

Public

Center Devoted to Forest Recreation Research

Hubert D. Burke has been named as center leader of a recently reorganized forest research center at Warren, Pa. This center will be the first U. S. Forest Service establishment in the country devoted primarily to research in forest recreation. Related studies will also be conducted in wildlife habitat, forest management, and the multiple use of forest lands.

Announcement of this was made by Ralph W. Marquis, director of the Northeastern Forest Experiment Station.

HUBERT D. BURKE

The Warren Center, one of nine field centers of the Northeastern Station, includes the Pocono Experimental Forest near Gouldsboro and the experimental forest at Kane.

The center will be responsible for recreation and wildlife research for the northeastern states and for forest management studies in the Allegheny Plateau.

Studies at the Warren Research Center will in part attempt to solve the many problems that have been brought about by the rapidly growing demands for recreational use of forest lands. They will try to find out how camping, picnicking, hunting, hiking, and fishing, and other outdoor activities fit into the concept of multiple use of forest lands, and how one activity can harmonize with another.

Burke was graduated from Colorado A. & M. in 1936 with a B.S. degree in forestry. He then joined the Rocky Mountain Forest and Range Experiment Station. From 1941 until 1946 and 1951 until 1954 he served with the U. S. Army.

Prior to assuming his duties at Warren, Burke was in charge of the Vicksburg Research Center, Southern Forest Experiment Station, working in cooperation with the U. S. Army Engineers Waterways Experiment Station at Vicksburg, Miss.

Gill Joins Forest Service Research Staff

Thomas G. Gill, formerly manager of the Timber Engineering Company's Research and Development Laboratory in Washington, D. C., has joined the Washington Office staff of the Division of Forest Economics Research, U. S. Forest Service. In his new position, he will conduct studies of regional and national consumption and potential requirements for forest products.

Gill, a native of Columbus, Ohio, studied engineering at Ohio State Uni-

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versity for two years. He transferred to the School of Forestry, University of Michigan where he received his master's degree in Forestry in 1931.

After several assignments as a forester and technologist with the Forest Service, Soil Conservation Service, and War Department, Mr. Gill joined Timber Engineering Company in 1947. While with that company he planned, conducted and supervised a variety of research in forest products utilization.

Three Appointments to Pacific Southwest Station

Director Keith Arnold of the U. S. Forest Service Southwest Pacific Forest and Range Experiment Station has announced three additions to the Station's staff.

Dr. William B. Critchfield will do research on the genetics of forest trees at Berkeley and Placerville. Previously he was with the Maria Moors Cabot Foundation for Botanical Research at Harvard University.

Dr. John Romberger has been assigned to the Station's forest tree physiology laboratory at Pasadena where he will carry on basic research in cooperation with the California Institute of Technology. He was formerly a post-doctoral research associate at that institution.

George Frazier, formerly assistant forest economist at the University of Idaho, will head studies of ponderosa pine log grades in the Station's Division of Forest Economics Research.

OPEDA Award to Kneipp

Leon F. Kneipp received an award from the Organization of Professional Employees of the U. S. Department of Agriculture, November 23, 1959 in the Jefferson Auditorium of the Department, Washington.

The award, the first of its kind, is given to a person best exemplifying the organization's code of ethics. The code calls for: "Courteous, efficient, and impartial service to the American people; loyal, faithful, and devoted service to the Government; and moral support and recognition to associates."

Mr. Kneipp retired from the Forest Service in 1946, as assistant chief in charge of lands: acquisition, exchanges, and classification.

Regional Engineer Retires

Henry M. Shank, chief of the Division of Engineering, U. S. Forest Service regional office, Denver, Colo., retired in December, 1959.

Mr. Shank started his career with the Forest Service in the Intermountain Region in 1921. He advanced through various engineering and forest supervisory assignments, including service at the regional office of the Intermountain Region at Ogden, Utah, both in the Division of Operation and as chief of the Division of Engineering, and the Challis and Idaho National Forests in Idaho, as forest supervisor. Prior to starting his Forest Service career, he served as an officer in the U. S. Corps of Engineers in France during World War I.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

Positions Wanted

Forester, A.A., B.S.F., in 1954, Michigan College of Mining and Technology. Age 33, married, 3 children. Experienced in scaling and shift supervising with large pulp and paper company. Wish work in Forest Nursery. Forest Plantations or Forest Management and Research. Prefer Midwest area but will consider offers in other areas.

Box V, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S., 1959, Univ. of Massachusetts. Age 24, married. Desires to begin career in forestry with position in forest management with private industry, preferably in the Northeast.

Box W, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S., Montana, 1956. Age 27, married, one child. Experience: 4 summers with Forest Service, 9 months with private industry. Work included all phases of timber mgmt., cruising, scaling, marking sales, administration, surveying, road location. Will be available the last of April upon fulfillment of my military obligation. Desire position with private industry; prefer Western location.

Box X, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S., 1948. University of Washington. Age 40, married, three children. 11 years experience: 4 years manager Log & Timber Division, western firm; timber sale analysis, supervision, logging contracts, booms, storages, purchase of logs including foreign hardwood imports, quality control of logs to mill. Also experience with veneers and lumber.

Box Y, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S., 1956. Age 25, married, two children. Three years experience in all phases of timber land appraisal, acquisition, and management. Some experience in supervision of logging and improvement of logging practices. Active in church, civic and professional organizations. Desires responsible position in sales in related fields, or in land management. Prefer Southern location.

Box Z, Journal of Forestry, Mills Building, Washington 6, D. C.

Consulting Foresters

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20. Wood seasoning.
21. Wood technology.

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Territory: Northeastern U. S., esp. Adirondack Mountains.
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Ernest E. Ahler, Forest Consultant, Route 2, Bishop Road, Knoxville 18, Tennessee.
Territory: Southeast.
Specialization: 2, 3, 4, 6, 13, 16, 17, 18. Also preparation, negotiation or advertisement, and administration of timber sales for large and small timber landowners, boundary line establishment, contract sawmilling, and reforestation.

Airview Specialists Corp., 48 Thomas Lane, Pleasant Hill, California. Aerial surveys — mapping — forestry services.
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Thos. W. Alexander, Consulting Forester, Waynesville, North Carolina.
Territory: South, Central States, and Appalachians.
Specialization: 2, 4, 11, 16, 17.

I. V. Anderson, E. 13008 Maxwell, Spokane 67, Washington.
Territory: Eastern Washington and Oregon, Idaho, Montana, and other Rocky Mountain states to Mexico.
Specialization. 3, 4, 11, 16, 17, 18. Including special work on evaluation of ponderosa pine quality and procurement of specialty woods.

John R. T. Andrews, 1450 O'Connor Drive, Toronto 16, Canada. Hunting Technical and Exploration Services, Ltd.
Territory: World wide including tropical forestry.
Specialization: 2, 4, 8, 10, 11, 15, 16, 17, and 18. Also integrated resource surveys and mapping, using photogrammetric techniques.

Glenn O. Antonie, Consulting Forester, 411 South Walnut, Demopolis, Alabama.
Territory: Alabama, Mississippi.
Specialization: 2, 3, 4, 5, 6, 7, 8, 12, 13, 15, 16, 17, 18. Also agent for absentee timber owners; timber sales and cutting supervision; forest litigation.

***James E. Asher**, Consulting Forester, P. O. Box 723, Lake Arrowhead, California.
Consultant: James E. Asher.
Territory: Southern California (not restricted).
Specialization: 1, 3, 4, 5, 6, 7, 10, 15, 16, 17, 18.
Specialized in southern California mountains unique and intense timber management, reforestation problems. Also forest damage and trespass investigation, appraisal, litigation; timber sales, preparation through supervision; native landscaping; advisories, individual tree problems through large management planning; right-of-way inventory-appraisal.

S. Gayley Atkinson, Consulting Forester, 1955 Huntingdon Road, Huntingdon Valley, Pennsylvania.
Territory: Pennsylvania.
Specialization: 1, 18.

Atlantic States Forestry Company, Carthage, North Carolina.
Territory: Eastern and southern United States.
Specialization: 2, 3, 4, 8, 9, 15, 16, 17, 18. Also forest damage appraisals, litigation, timberland sales and purchases, aerial photo-controlled cruises. and reconnaissance from aircraft.

***Henry L. Bango**, Consulting Forester, P. O. Box 4072, Shreveport, Louisiana.
Consultant: Frank Gaensehals.
Territory: Northern Louisiana, south Arkansas, east Texas.
Specialization: 3, 4, 5, 16, 17, 18. Also purchase and sale of timbered properties.

George Banzhaf & Company, 662 North Water St., Milwaukee 2, Wisconsin.
Territory: Not limited.
Specialization: 2, 3, 4, 11, 13, 15, 16, 17.

***W. R. Barnhill**, 1113 Gillespie Ave., Albany, Georgia.
Specialization: 4, 11, 12, 15, 17, 18. Also forest damage investigations, tree planting (contract).

Curtis H. Bauer, Consulting Forester, 54 Dearborn Street, Jamestown, New York.
Territory: Western New York and Pennsylvania.
Specialization: 2, 3, 4, 13, 16, 17, 18. In addition to serving the local lumber industry and woodland owners, services are designed for the Christmas tree industry.

Russell W. Beeson, Wildland Management Consultant, 17 Highland Boulevard, Berkeley 7, California. Telephone: Landscape 5-6906.
Territory: California and Arizona.
Specialization: 4, 6, 9, 14, 16, 17, 18. Also range, watershed and flood control surveys. Land exchanges involving Bureau of Land Management or Forest Service lands.

Belanger and Bourget, Land Surveyors and Forest Engineers, 86 Cote de la Montagne, Quebec, Canada.
Consultant: M. Albert Bourget.

Territory: Canada, especially Quebec.
Specialization: 2, 3, 4, 10, 11, 13, 15, 16, 17, 19, 20, 21. Also boundary lines.

***Frank W. Bennett & Associates**, Consulting Foresters, 4767 Convention Street, Baton Rouge, Louisiana. (Field Headquarters at Norwood, La., Alexandria, La., and Hammond, La.)
Consultants: Frank W. Bennett, Anatol Kaszkurewicz, and Lionel J. Melanson, Jr., Baton Rouge, Louisiana; Lewis C. Peters, 211 West Thomas Street, Hammond, Louisiana; and James E. Moore, 5106 Leonard Boulevard, Alexandria, Louisiana.
Territory: Southern United States.
Specialization: 3, 4, 6, 10, 11, 16, 17, 18. Retained as consultants by medium-size landowners (500 to 50,000 acres). Manage all forest land resources, including timber, grazing, wildlife, minerals, etc. Make plant location surveys for large wood using plants (pulp mills).

Bigley and Feiss, Foresters, Inc., 767 Blair Blvd., Eugene, Oregon.
Consultants: Sherman Feiss, John Venator, Howard G. McDowell.
Territory: Washington, Oregon, California.

John C. Billingsley, Forest Consultant, 924 Fair Street, Newberry, South Carolina.
Consultant: C. Ashley Abel.
Territory: South Carolina and Georgia.
Specialization: 3, 4, 5, 9, 10, 15, 16, 17, 18.

Bishop Brothers, Consulting Foresters, Marion, South Carolina.
Consultants: H. F. Bishop, Marion, S. C.; R. Q. Bishop, Florence, S. C.
Territory: South Carolina and southeastern United States.
Specialization: 3, 4, 6, 8, 10, 13, 15, 16, 17, 18.

L. L. Bishop, Forest Consultant, 7034 Airline, Houston 9, Texas.
Territory: East Texas.
Specialization: 4, 6, 16, 18.

Lewis M. Boice, Consulting Forester, Orangeburg, South Carolina.
Territory: Within 100 miles of Orangeburg.
Specialization: 4, 5, 6, 7, 13, 16, 17, 18.

***William J. Bozett**, Consulting Forester, Logan, Ohio.
Territory: Unlimited.
Specialization: 2, 3, 4, 5, 6, 7, 10, 11, 13, 15, 16, 17, 18, 20. Forest management and marketing, land acquisition for investors, damage appraisals, Christmas tree management and tree planting, serving industry.

Allen W. Bratton, Consulting Forester, Shelterwood, Cooperstown, New York.
Territory: Northeast.
Specialization: 4, 5, 6, 7, 8, 11, 15, 16, 17, 18.

Brown and Brown, Forest Engineers, 612 U. S. National Bank Bldg., Portland 4, Oregon.
Consultants: Eugene R. Walsh (S.A.F. Associate Member), Samuel Rotschy.
Territory: Pacific coast.
Specialization: 2, 3, 4, 6, 8, 10, 11, 12, 15, 16, 17, 18.

Nelson C. Brown, Consulting Forester, 122 Dorset Road, Syracuse 10, New York. During summers, Milford, Pa.
Territory: Northeast.
Specialization: 2, 3, 8, 10, 11, 13, 16, 17.

Harold R. Bruning, Consulting Forester, Route 1, Beulah, Michigan.
Territory: Michigan.
Specialization: 4, 13, 15, 16, 17. Also Christmas tree management, registered forester and registered land surveyor.

Paul E. Bruns, Box 44 Durham, New Hampshire.
Territory: Specialist in Northern Rocky Mountain area.
Specialization: Limited to fair market valuation of timber stands, and management problems.

Charles H. Bunting, Consulting Forester, 1217 Placer St., Redding, California.
Territory: Pacific Coast.
Specialization: 2, 4, 8, 10, 15, 16, 17. Also certified log scaling service; punched card data processing service.

Robert H. Cain, Consulting Forester, 1423 College Drive, Pineville, Louisiana.
Territory: Louisiana.
Specialization: 4, 6, 7, 13, 15, 16, 17, 18. Timberland agent, private and industrial.

Cal-Pacific, Forest Consultants, 5524 Elvas Ave., Sacramento 19, California; also P. O. Box 733, Soquel, California.
Consultants: James E. Greig, Harvey A. Striplin, Jr., Joseph Griggs, Edward A. Tunheim.
Specialization: Timber management, cruising, sales.

***N. D. Canterbury**, Consulting Forester, Parklane Apts. 310, 5701 Jackson St., Houston 4, Texas.
Territory: Texas and southeastern U. S.

Capital Forestry Co., Inc., 2967 Troy Road, Schenectady 9, New York.
Consultant: Ernest L. Handy, Forester and Landscape Architect.
Territory: New York, New England States, Pennsylvania, and New Jersey.
Specialization: Arboriculture, landscape designing and planting, tax and insurance appraisals. Experienced in court testimony as qualified expert.

Dudley C. Carey, 116 Fairmeade Road, Louisville 7, Kentucky.
Territory: Not limited.
Specialization: Forest and wood utilization, wood preservation, wood seasoning, wood technology. Also wood conversion planning.

Carl M. Carpenter, Consulting Forester, Nashville, Indiana.
Territory: Indiana.
Specialization: 2, 4, 5, 6, 15, 16, 17, 18.

***Clifford B. Carts**, Consulting Forester Box 267, Coudersport, Pennsylvania.
Territory: Pennsylvania, New York, Ohio.
Specialization: 3, 4, 8, 10, 11, 15, 16, 17, 18. Also timber trespass and timber damage appraisal; management agent for timberland owners.

Ralph E. Chamberlin, Consulting Forester, River House 810, 2311 N. Front Street, Harrisburg, Pennsylvania.
Territory: Eastern United States.
Specialization: 2, 4, 15, 16, 17, 18. Also timber investment, farm and forest real estate, forest tree nurseries, Christmas tree management, and Harrisburg representative.

Edward J. Clancy, 1916 Sylvan Road, S. W., Atlanta, Georgia.
Territory: Northern Georgia and adjoining states.
Specialization: 4, 15, 16, 17. Also agent for timber owners.

John T. Clark, Consulting Forester, Box 923, Quincy, Florida. (Affiliate Member.)
Territory: Southwest Georgia and northwest Florida.
Specialization: 3, 4, 13, 16, 17, 18. Also management of farm woodlots, hand planting, and control of undesirable hardwoods by hand.

Stuart F. Clark, Consulting Forester, Box 3222, Bellaire, Texas.
Territory: Southern United States.
Specialization: Forest management, appraisals, investments.

Francis H. Clifton, Private Forester, P. O. Box 899; Office, 320 N. Boulevard, Deland, Florida.
Territory: Southeast U. S. A.
Specialization: General forestry, realtor, real estate sales and appraisals, forestry exhibits sales.

***T. S. Coile, Inc.**, Forest Lands Consultant, Rt. 2, Box 376, Durham, North Carolina.
Specialization: Soil productivity and its implications in forest land management. Soil surveys and their interpretation for forest management. Forest management planning based on integration of ecological and financial factors. Land evaluation, general forestry consulting service.

Commercial Foresters, Inc., P. O. Box 1274, Asheville, North Carolina.
Foresters: Richard A. Wood and Thomas A. Hudgens.
Territory: Appalachian and Southeastern.
Specialization: 2, 3, 4, 10, 11, 13, 16, 17, 18. Also complete timber marking and sale service and watershed management.

Connwood, Inc., P. O. Box 111, Rockfall, Connecticut.
Consultants: Ralph C. Hawley, Michael M. Pochan, Jr., Sherman H. Perkins, Stanley T. House.
Territory: Connecticut, Rhode Island, and adjacent areas.
Specialization: 3, 4, 10, 11, 13, 15, 17, 18, 19, 21.

David B. Cook, Consulting Forester, 12 McPherson Terrace, Albany 6, New York.
Territory: Eastern New York.
Specialization: Planted larch, chemi-peeling, and basal spray.

***Philip T. Coolidge**, Consulting Forester, retired. Box 102, Bangor, Maine.
General forestry.

Porcius F. Crank, Jr., Consulting Forester, Point Harbor, Currituck County, North Carolina.
Territory: North Carolina and Virginia.
Specialization: 4, 5, 6, 7, 13, 15, 16, 17, 18. Also registered surveyor.

***Keith Cranston,** Forestry Consultant, Leland, Mississippi.
Territory: Mississippi River Delta, entire Gulf Coast and Southeast hardwood bottomlands and pine types.
Specialization: Pine and bottomland hardwood management, and supplemental commercial cruising. Retained in consultant capacity by firms operating in the South, and as consultant-manager for private landowners of bottomland hardwood and pine tracts. Appraisal of estates and division of lands. Loan appraisals.

Keith Cranston Employment Aides, Forestry Consultant, Leland, Mississippi.
Consultant: *Keith Cranston, Personnel director.
Specialization: Personnel placement service provided professional foresters and timbermen. Service to industry.

John M. Crowl, Forest Lane Drive, Madisonville, Kentucky.
Territory: Western Kentucky.
Specialization: 4, 5, 6, 13, 14, 16, 17, 18.

John R. Curry, Forest Consultant, Saranac Lake, New York.
Territory: Northeastern States.
Specialization: 3, 4, 8, 10, 13, 16, 17, 18.

Lucas M. Dargan, Consulting Forester, Route #3, Darlington, South Carolina.
Territory: Coastal Carolinas.
Specialization: 4, 6, 9, 16, 17, 18.

***John F. Davis,** Ironshire and Mumford, Snow Hill, Maryland.
Territory: Eastern and Southeastern states.
Specialization: 2, 3, 4, 11, 13, 16, 17, 18.

Paul B. Davis, Consulting Forester, 118 E. Malta Road, Oak Ridge, Tennessee.
Territory: Tennessee, Kentucky.
Specialization: 1, 2, 3, 4, 13, 16, 17, 18.

Ralph A. Davis, Jr., Consulting forester and wood dealer, 2026 Avenue Q, Huntsville, Texas.
Territory: East Texas, Louisiana.
Specialization: 2, 3, 4, 10, 11, 13, 16, 17, 18. Also forest damage appraisal, land acquisition. Agent for absentee landowners, timber sales and cutting, supervision loan appraisals, and land appraisal.

Randle J. Dedeaux, Consulting Forester P. O. Box 57, Perkinson, Mississippi.
Consultant: Randle J. Dedeaux.
Territory: Southern Mississippi; longleaf and slash pine types.
Specialization: 4, 13, 15, 17. Also growth studies, timber marking and marketing, and agent for absentee timberland owners.

Deep South Consulting Foresters, 218 Broward St., Tallahassee, Florida.
C. H. Schaeffer, Chief Forester.
Territory: Alabama and south Georgia.
Specialization: 4, 6, 16, 17.

Elwood L. Demmon, 241 Old Toll Road, Asheville, North Carolina.
Territory: Unlimited.
Specialization: Consultant on forest management policy for large forest properties; review and criticism of forestry research programs.

H. C. Dickerson, Consulting Forester, P. O. Box 348, Kilgore, Texas.
Territory: Texas and Louisiana.
Specialization: 2, 4, 5, 16, 18, and 19.

Di Stefano, Wessel, and Williams, Attorneys and Counsellors at Law, 1411 Walnut Street, Philadelphia 2, Pennsylvania.
Consultant: Henry Wessel.
Territory: Northeast and Middle Atlantic Region.
Specialization: 2, 8, 11, 15, 16, 17. Also general business problems including the formation of partnerships, corporations, financing and litigation; timber sales, probate work, estate planning and taxation.

George L. Drake, Forest Consultant, 902 Puget Sound Bank Building, Tacoma 2, Washington.
Territory: Western United States, Canada, and Alaska.
Specialization: 2, 4, 6, 7, 8, 10, 15, 16, 17.

Henry E. Duckett, Jr., Consulting Forester, Worcester, Vermont.
Territory: Northeastern U. S.; Esp. Green Mountains.
Specialization: 3, 4, 5, 6, 7, 8, 9, 15, 16, 17, 18. Also trained crew for timber stand improvement work.

Eastern Forestry, Inc., Box 6, Wake, Virginia.
Consulting Forester: *Edward Stuart, Jr.
Territory: Eastern U. S.
Specialization: 2, 3, 4, 10, 11, 13, 14, 15, 16, 17, 18. Also timberland investment counsel.

William A. Eastman, Jr., Consulting Forester, William A. Eastman & Co., Inc., 410 Green Building, Seattle 1, Washington.
Territory: Pacific Northwest.
Specialization: 10, 16, 17. Also preparation and administration of timber sales, land appraisal, timberland brokerage, and timberland management.

James E. Ebert, Consulting Forester, Pembroke, North Carolina.
Territory: Eastern North Carolina.
Specialization: 4, 6, 13, 16, 17.

W. G. Edwards, 503 West Fairmount Ave., State College, Pennsylvania.
Specialization: 3, 10, 13, 15, 16, 18. Also small sawmill problems, both logging and milling phases.

Ivan M. Elchibegoff, Consulting International Forest Economist, 4206 Kaywood Drive, Mt. Rainier, Maryland. (Associate Member, SAF.)
Territory: Worldwide.
Specialization: 2, 3, 8, 11. Also resource surveys, land utilization, developmental economics, and international trade.

L. J. Enright, Consulting Forester, 322 Scott Drive, Silver Spring, Maryland.
Territory: Maryland; not limited.
Specialization: 1, 6, 15, 18. Also park management and policy; landscape planting and design.

Farmcraft Associates, Inc., Forest Managers, 619 Washington Street, (Box 4344), Alexandria, Louisiana; Box 322, Oakdale, Louisiana; and 324 Avoyelles Drive, Alexandria, Louisiana.
Consultant, Printis Murphy.
Territory: Southern U. S.
Specialization: Forest investments and technical forest management for private and industrial holdings. Also litigation and damage appraisals.

Fesla Company, Robert L. Curtis, Consulting Forester and Licensed Surveyor, 536 Beverly Drive, Magnolia, New Jersey.
Territory, U. S. and Foreign.
Specialization: 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 13, 15, 16, 17 18.

***David S. Findlay,** Consulting Forester, 20 East 5th Street, Jamestown, New York.
Territory: Western New York and Pennsylvania.
Specialization: 4, 15, 16, 17.

Henry B. Fishburne Consulting Forester. The Crescent, Charleston 44, South Carolina.
Territory: Southeast.
Specialization: 3, 4, 6, 10, 13, 15, 16, 17, 18. Timberland loans.

Reginald D. Forbes, Consulting Forester, R.F.D. 1, Ambler, Pennsylvania.
Territory: Eastern U. S.
Specialization: 4, 6, 17, 18. Also forest resource surveys of timber available to manufacturing plants in specified territories.

Forest Land Management Co., P. O. Box 1046, Morgantown, West Virginia.
Consultant: *Thomas G. Clark.
Territory: West Virginia, western Pennsylvania, western Maryland.
Specialization: Forest land appraisal, forest real estate, timber sales, and markets.

Forest Products Management Company, 1504 Broad Street, Camden, South Carolina.
Consultant: *H. R. Oliver.
Territory: Southern states.
Specialization: 2, 3, 4, 6, 7, 11, 15, 16, 17, 18. Also land appraisals, timber and land sales and bottomland hardwood management.

Forest Services, Inc., 4600 Pio Nono Ave., P. O. Box 1112, Macon, Georgia.
Consultant: Reuben W. Martin, Jr.
Territory. Southern states.
Specialization: 4, 7, 8, 13, 15, 16, 17, 18. Also aerial application of herbicides and insecticides, direct seeding from fixed wing aircraft or helicopter and contract tree planting.

Foresters, Inc., 104 Black Hawk Lane,

West Lafayette, Indiana. Clair Merritt, Secretary-Treasurer.
Territory: Central States.
Specialization: 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 15, 16, 17, 18, 19, 20, 21.

Forestry Consulting Services, Inc., Deluxe Building, 297 West Michigan Avenue, Jackson, Michigan.
Consultant: *George D. Blair, registered forester.
Territory: Nationwide.
Specialization: 1, 2, 4, 11, 16, 19. Also various forest growth and vegetative control planning services to public utility industry.

Forestry Suppliers, Inc., Consulting Foresters and Suppliers, Battlefield Station, Jackson 4, Mississippi.
Consultants: *James W. Craig, and Purvis R. Huff.
Territory: Gulf States.
Specialization: 3, 4, 6, 13, 15, 16, 17, 18. Also forest land analysis and management, growth studies, timber and land sales, and a complete line of supplies and equipment for foresters and timber owners.

John S. Forrest, Consulting Forester, 198 Maxwell, Eugene, Oregon.
Territory: Douglas-fir region.
Specialization: 2, 3, 4, 6, 15, 16, 17, 18. Also negotiation and administration of private timber sale contracts; aerial photography procurement contracts; property management for absentee owners; industrial inventory and sustained yield programs.

E. A. Foster, 204 E. Azalea St., Lakeland, Florida.
Territory: Southeastern United States.
Specialization: 2, 4, 5, 6, 7, 8, 13, 15, 16, 17, 18. Also timber marketing services and aerial photo interpretation.

Harvey R. Frantz, Forest Consultant, 1926 Jennings St., Bethlehem, Pennsylvania.
Territory: Eastern United States and Latin America.
Specialization: 3, 4, 11, 13, 16, 17.

***R. C. Fraunberger**, Forest Products Business Consultant (registered forester), 626 Black Rock Road, Bryn Mawr, Pennsylvania.
Specialization: 2, 3, 4, 10, 11, 16, 17, especially in hardwoods, domestic and foreign.

E. A. Friend, Jr., 1008 Delaware Avenue, Suffolk, Virginia. (Inactive.)
Territory: Tidewater and Eastern Shore of Virginia, northeast North Carolina.
Specialization: 4, 15, 16, 17. Absentee landowners' agent, damage, trespass, and condemnation claims.

Emanuel Fritz, Consulting Forester, 102 The Uplands, Berkeley 5, California. In association with E. T. F. Wohlenberg, 37 Highland Circle, Ukiah, California.
Territory: West; pine, redwood, and fir.
Specialization: 2, 3, 4, 6, 10, 11, 16, 17, 18, 19, 20, 21. Also consultant on state forest and park management and policy.

LeRoy Frontz, Consulting Forester, Allenwood, Pennsylvania.
Territory: Eastern U. S.
Specialization: 3, 4, 5, 6, 7, 9, 16, 17, 18. Also landscaping, forest and ornamental nurseries, farm forestry, forest parks and recreation, landuse planning, soil conservation, farm evaluation and appraisal.

Edward P. Furlow, 810 Gouthier Road, Falls Church, Virginia.
Territory: Virginia, Maryland, West Virginia.
Specialization: 4, 13.

Charles G. Geltz Associates, Forestry-Educational Counselor, 1521 N. W. 7th Avenue, Gainesville, Florida.
Territory: South; Vocational education.
Specialization: Silviculture, nursery practice, reforestation.

George I. Gentry, Forester, 3401 Middlefield Lane, Eureka, California.
Territory: California.
Specialization: 4, 17. Also contract logging supervision.

L. Neil Gilliam, 2135 Everding Street, Eureka, California.
Territory: California.
Specialization: Timber cruising, timber management, logging contracts, and timber sales.

Good Forest Management Co., Vernon A. Good, Consulting Forester, American Bank Building, Portland, Oregon.
Territory: Oregon, Washington, Idaho, northern California.
Specialization: 2, 4, 8, 13, 14, 16, 17, 18. Forest property management, timber marking, sales contracts and supervision, acquisition, aerial photo inventory, fire damage appraisals, and timber tax assistance. Also watershed and land use management.

Paul N. Goodmonson, Consulting Forester, 1355 Alta Vista Drive, Corvallis, Oregon.
Territory: Oregon, Washington, northern California.
Specialization: 3, 4, 9, 13, 15, 16, 17, 19. Complete timberland management, timber sales, timber and land acquisition, and agent for absentee forest owners.

M. W. Gormely, B.C.R.F., P. Eng., Industrial and Consulting Forestry Service, Room 413, Dominion Bldg., 207 West Hastings St., Vancouver 3, B.C.
Territory: British Columbia: (No regional limitation).
Specialization: 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 15, 16, 17, 18. Also fire damage appraisal and timber insurance evaluation.

R. W. Graeber, Consulting Forester, 303 Hillcrest Road, Raleigh, North Carolina.
Territory: North Carolina.
Specialization: 4, 6, 13, 16, 17, 18. Also buying and selling timber and timberlands as service to either buyer or seller; adjusting problems arising from over-cutting or trespass.

Joseph F. Gray, Consulting Forester, R. D. #1, Kittanning, Pennsylvania.
Territory: Pennsylvania.
Specialization: Christmas tree plantation management.

Green's Timber Service, Johnson City, Tennessee.
Consultant: L. Stanley Green.
Territory: Southeastern U. S.
Specialization: 2, 3, 4, 6, 10, 13, 16, 17, 18. Also custom sawmilling.

Greenacres, Inc., Forest Management and Investment Consultants, 6630 Rainier Avenue, Seattle 18, Washington.
Consultants: M. P. Lazara, Perry O. Donaldson, Allan C. Randall, P. Richard Kringle, J. C. H. Robertson, Ben S. Bryant, and C. S. Cowan, Fellow SAF.
Territory: Western North America, Central America, Southeast Asia.
Specialization: 2, 3, 4, 6, 8, 10, 11, 13, 15, 16, 17, 18, 21. Forest investment consulting and tree farm acquisition and management. Complete feasibility studies and development plans for tropical operations. Logging engineering and licensed land survey work.

W. H. Griffith, Forester and Surveyor, 1001 Ouchita Bank Building, Monroe, Louisiana.
Territory: Southern United States.
Specialization: 15, 16, 17.

***John G. Guthrie**, Consulting Forester, Forest Management Service, Wiggins, Mississippi.
Territory: Mississippi and adjacent territory.
Specialization: 4, 6, 12, 13, 15, 16, 17, 18. Also retained as consultant-manager of private forest lands. Appraisals—land and timber. Acquisition. T.S.I., large scale planting.

Alvin B. Hafer, Consulting Forester, Laurinburg, North Carolina.
Territory: North Carolina, South Carolina, and Southeast.
Specialization: 2, 3, 4, 6, 15, 16, 17. Also purchase and sale of timbered properties.

***E. C. Haff**, Consulting Forester, 836 Edisto Ave., Orangeburg, South Carolina.
Specialization: Managing forest lands.

***Albert G. Hall and Associates**, 810 18th Street, N. W., Washington 6, D. C.
Consultants: *Charles M. Schwartz.
Specialization: 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 16, 17, 18. Also Washington representative.

Giles G. Hall, Professional Forester, P. O. Box 569, Augusta, Georgia.
Territory: South Carolina, Georgia.
Specialization: 2, 3, 4, 5, 6, 7, 10, 11, 13, 16, 17, 18. Also tree pruning in planted stands.

***Jack M. Hall**, Consulting Forester, Franklin Heights, Moultrie, Georgia.
Territory: Georgia, Florida, Alabama, and South Carolina.
Specialization: 4, 5, 6, 7, 11, 12, 15,

16, 17, 18. Also contract tree planting and fire plow planting preparation.

Hammon, Jensen, and Wallen, Mapping and Forestry Services, 660 Hegenberger Road, Oakland 21, California.
Consultants: Herbert A. Jensen, *Arnold F. Wallen.
Territory: United States, Central and South America, and foreign.
Specialization: 2, 3, 4, 6, 8, 10, 11, 13, 15, 16, 17, 18. Also planimetric and topographic mapping, land net delineation, general land classification for appraisal purposes and ranchland management, and aerial photogrammetric consulting service.

David H. Hanaburgh, Consulting Forester, Buchanan, New York.
Territory: Anywhere.
Specialization: 2, 3, 4, 9, 10, 11, 13, 16, 17. Also negotiation of rights for hunting, fishing, trapping and water storage.

Joseph F. Hardee, Consulting Forester, Route 7, Raleigh, North Carolina.
Territory: North Carolina, South Carolina, and Virginia.
Specialization: 3, 4, 13, 16, 17, 18. Also timber and timberland acquisition and sales.

Gene M. Harris, Registered Consulting Forester, 2112 Hagan Drive, Tallahassee, Florida.
Territory: Florida, Georgia, and Alabama.
Specialization: 3, 4, 5, 6, 7, 8, 9, 12, 13, 15, 16, 17, 18.

***Arthur W. Hartman,** Consulting Forester, 22 Princeton Way, N. E., Atlanta, Georgia.
Territory: Southern states.
Specialization: 4, 6. Prescribed burning, development planning, training and execution in silvicultural uses of fire with planned management of southern pines and for control of hazardous fuels. Also, fire protection planning, especially determining components of balanced mechanized fire control facilities and their tactical uses. (Registered forester, Georgia.)

Joseph F. Havel, Box 11, Pawley's Island and Georgetown, South Carolina.
Territory: North Carolina, South Carolina, Georgia, and Florida.
Specialization: 3, 4, 10, 11, 13, 16, 17.

E. T. Hawes, Consulting Forester, 2204 White Oak Drive, Valdosta, Georgia.
Territory: Southeast.
Specialization: 2, 4, 8, 11, 12, 13, 16, 17, 18.

Ralph W. Hayes, Consulting Forester, 2241 Myrtle Avenue, Baton Rouge, Louisiana.
Territory: Gulf States.
Specialization: 2, 3, 13, 15, 16, 17. Also investigation and settlement of claims regarding timber in use in the South.

V. W. Herlevich, Consulting Forester, 802 Forest Hills Drive, Wilmington, North Carolina.
Territory: North Carolina, South Carolina.
Specialization: 4, 6, 15, 16, 17. Also forest fire damage appraisals.

***Halsey M. Hicks,** Consulting Forester, Box 575, Brattleboro, Vermont.
Territory: Not limited.
Specialization: 2, 3, 4, 8, 15, 16, 17.

James E. Hobbs, Consulting Forester, Edenton, North Carolina.
Territory: Southeastern United States.
Specialization: 2, 3, 4, 8, 11, 13, 16, 17.

Monterey L. Holst, Consulting Forester, P. O. Box 125, East Greenwich, Rhode Island.
Specialization: 3, 4, 6, 9, 10, 13, 15, 16, 17, 18, 21.

Glon B. Hooker, 1072 Anzio St., Crescent City, California.
Territory: Northern California.
Specialization: 4, 15, 16, 17.

Douglas F. Horan, Consulting Forester, 316 Windsor Street, Lakeland, Florida.
Territory: Southeastern United States, Central and South America.
Specialization: Complete timber sales service, foreign timber investigations, agent for absentee timber owners.

William P. House, Consulting Forester, Chesham, New Hampshire (R.F.D. Marlboro.)
Territory: New Hampshire and adjacent areas.
Specialization: 2, 3, 4, 16, 17. Marking and stumpage sales.

Richard F. Howard, Forestwald, Box 14, Franklinville, New York.
Territory: Pennsylvania, New York, New England.
Specialization: 3, 4, 6, 15, 16, 17, 18.

***T. M. Howerton, Jr.,** Forestry Consultant, Madison, Florida.
Territory: Southeastern states.
Specialization: Marketing, management, and forestry supplies.

John E. Hudson, 806 N. W. 21st Terrace, Gainesville, Florida, or 57 N. Bay View Avenue, Fairhope, Alabama.
Territory: Southeastern United States.
Specialization: 4, 12, 16, 17.

LeRoy W. Huntington, Consulting Tropical Forester, 870 Wesley Street, Baldwin, New York.
Territory: Latin America, Orient, Africa.
Specialization: 2, 3, 4, 10, 11, 15, 16, 17, 18; and tropical hardwoods.

R. Wilson Hutchison, Consulting Forester and Logging Engineer, 167 Walnut Lane, Eugene, Oregon.
Territory: Washington, Oregon, California.
Specialization: 2, 3, 4, 6, 10, 15, 16, 17. Registered professional engineer of the State of Oregon.

Intermountain Timber Service, 4101 State Street, Boise, Idaho.
Consultant: *Thomas C. Clifton.
Territory: Idaho, northern California, eastern Oregon.
Specialization: 2, 4, 6, 8, 15, 16, 17. Also logging road construction cost studies, and logging cost studies made. Buying and selling of timber and timberlands as a service to either buyer or seller.

Leo A. Isaac, Forest Consultant, 3520 N. E. Hancock Street, Portland 13, Oregon.
Territory: World-wide but prefer Washington and Oregon.
Specialization: 4, 18. Management of timber properties and the selection of tree seed for reforestation.

Gorham E. Jackson, Consulting Forester, 604 West Main Street, Washington, North Carolina.
Territory: Eastern North Carolina, southeastern Virginia. All forest types.
Specialization: 2, 4, 6, 9, 10, 13, 15, 16, 17, 18. Also investigations of forest resources for pulp and paper companies, and land agent for absentee timberland owners.

Norman G. Jacobson, Consulting Forester, 620 Security Building, Tacoma, Washington.
Specialization: Forest management, forest protection, timber and land appraisal, taxation and forestry policy.

Alex J. Jaenicke, 2941 Mulkey St., Corvallis, Oregon.
Territory: Oregon, Washington, California, Idaho, and Montana.
Specialization: 4, 5, 7. Also volume estimates of insect- and disease-killed timber and rates of deterioration for management and taxation purposes.

David G. Jennings, Consulting Forester, 179 Carroll St., Jefferson Station, New York.
Territory: New York.
Specialization: 1, 3, 4, 6, 15, 18.

Hyland R. Johns, Jr., Consulting Forester, Asplundh Tree Expert Co., Jenkintown, Pennsylvania.
Territory. Nationwide.
Specialization: Arboriculture and tree preservation, street tree management, chemical control of vegetation.

***F. J. G. Johnson and Associates, Ltd.,** Suite 605, 325 Howe Street, Vancouver 1, B. C., Canada.
Territory: British Columbia (no regional limitation).
Specialization: 2, 3, 4, 6, 11, 15, 16 17.

E. V. Jotter, Consulting Forester, 30 Cedarlawn Dsive, Dayton 15, Ohio.
Territory: Ohio, Kentucky.
Specialization: 3, 4, 6, 9, 11, 16, 17, 18. Also development and management of community forests, conservation education, cooperation with soil conservation districts.

Frank E. Karpick, 130 Kay St., Buffalo, 15, New York.
Territory: Northeastern United States.
Specialization: Planning and maintenance programs for municipal shade trees.

***The S. G. Keedwell Company,** Consulting Foresters, Emporia, Virginia.
Territory: Eastern and southern U. S.
Specialization: 3, 4, 10, 11, 13, 15, 16, 17. Also forest litigation and purchase and sale of land and timber.

John F. Kellogg, Forester, Box 87, Hall Summit, Louisiana.

Territory: Louisiana; pine and hardwood.
Specialization: 4, 5, 11, 16, 17.

***George C. Kiefer, Jr.,** Consulting Forester, Salisbury, Connecticut.
Territory: Southern New England, eastern New York.
Specialization: 4, 6, 8, 15, 16, 17, 18. Also management of timber properties and plantations, timber marking and marketing, watershed management, and agent for woodland owners.

H. Thorn King, Consulting Forester and Land Surveyor, Hancock, New Hampshire.
Territory: Southwestern New Hampshire.
Specialization: 2, 3, 4, 15, 16, 17, 18. Also tree farming; marking; registered land surveyor.

John H. Kinghorn, Route #2, Lake George, New York.
Specialization: 2, 4, 6, 11, 13, 15, 16, 17, 18.

Ed Knapp Company, Consulting Foresters, 4425 Pio Nono Avenue, Macon, Georgia.
Consultants: G. Ed Knapp, Donald L. Martindale (both registered foresters).
Territory: Southern states.
Specialization: 2, 3, 4, 10, 11, 13, 16, 17, 18.

Robert F. Knoth & Company, Foresters, Appraisers, Surveyors, 132 East Bay Street, Charleston 3, South Carolina.
Consultant: *Robert F. Knoth.
Territory: Domestic and foreign.
Specialization: 4, 6, 10, 11, 13, 15, 16, 17, 18. Land agent for absentee timberland owners; foreign timberland investigations; veneer log procurement; timber acquisitions; sales, investments, and loans.

Arthur Koehler, Wood Technologist, 1959 Thayer Ave., Los Angeles 25, California.
Specialization: Wood utilization.

J. Hugo Kraemer Associates, Consulting Foresters, 249 Lark Street, Albany 10, New York.
Territory: New York and New England.
Specialization: 2, 3, 4, 6, 11, 15, 16, 17, 18, 21. Also timberland management and research projects.

Cornelius W. Kuhn, R. D. #2, Cattaraugus, New York. On sabbatical leave as forester—Redding, California.
Specialization: Timber evaluation and general woodlot problems, reforestation.

Clifton LaBree, Forest Consultant, R.F.D. Wilson Hill Road, New Boston, New Hampshire.
Territory: Northeastern United States.
Specialization: 2, 3, 4, 5, 6, 7, 8, 10, 13, 15, 16, 17, 18. Also timber sales, long-term forest land leases or management contracts, and land surveying.

Paul E. Lachance, Consulting Forest Engineer, Grenier, Grenier and Lachance, 675 St. Amable Street, Quebec, P. Q., Canada.
Specialization. 6, 8, 9. Member Canadian Institute of Forestry and Empire Forestry Association.

William N. Lane, Forest Management Consultant, Crown Point Road, Rochester, New Hampshire.
Territory: Northeastern United States.
Specialization: 2, 3, 4, 5, 6, 7, 8, 11, 13, 15, 16, 17, 18. Also damage surveys, forest litigation, timber depletion accounting, and timber investment reports.

The Langdale Company, P. O. Box 980, Valdosta, Georgia.
Consultants: Harley Langdale, Jr., T. E. Connell.
Territory: Georgia, northern Florida; slash pine belt.
Specialization: 2, 3, 4, 6, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19.

Jack E. Larson, 5524 Elvas Avenue, Sacramento 19, California.
Consultants: Jack E. Larson, Henry C. Schwartz.
Territory: Western states.
Specialization: 2, 3, 4, 6, 7, 8, 10, 11, 15, 16, 17, 18. Also land and timber appraisals for purchase, sale, exchange, or taxation; licensed land surveyor. Land and timber sales; logging supervision.

D. E. Lauderburn, 1204 Adeline St., Hatticsburg, Mississippi.
Territory: South Mississippi and adjacent territory.
Specialization: 2, 3, 4, 11, 12, 13, 16, 17. Timber sales service including marking, supervision, and inspection.

Frank J. Lemieux, Consulting Forester, 1015 Whitney Building, New Orleans, Louisiana.
Territory: Southern states, Mexico, Central and South America.
Specialization: 2, 4, 6, 13, 15, 16, 17.

Paul C. Lemon, Consulting Forester, State College, Albany 3, New York.
Territory: New York and New England.
Specialization: 1, 6, 9, 14. Also commercial pilot, applications of aviation to forestry.

T. A. Liefeld, Consulting Forester, Thomasville, Georgia.
Territory: Florida, Georgia.
Specialization: 2, 3, 4, 5, 6, 7, 8, 11, 12, 13, 15, 16, 17, 18.

L. D. Lloyd, Consulting Forest and Logging Engineer, Flying L Ranch, Glenwood, Washington.
Territory: Worldwide.
Specialization: 2, 3, 4, 6, 8, 10, 13, 15, 16, 17.

Harvey J. Loughead, Consulting Forester, 399 Vanderbilt Road, Biltmore, Station, Asheville, North Carolina.
Territory: Eastern U. S.
Specialization: 3, 4, 12, 13, 16, 17. Also watershed management.

Robert T. MacDougall, Jr., 124 Cresta Drive, Ukiah, California.
Territory: Coast pine and southern redwood regions of California.
Specialization: Timber cruising, forest management, mapping.

***Donald K. Maissurow,** Consulting Forester, New Haven Avenue, Derby, Connecticut.
Territory: New England.
Specialization: 1, 4, 15, 16, 17. Also landscape forestry.

A. R. Maris, Box 122, Forks, Washington.
Territory: Olympic Penninsula of Washington state.
Specialization: Logging engineering, timber cruising, land surveying, tree farms, and all general forestry work including land apraisals.

Carol W. Marlow, 4232 Redonda Lane, Dayton 6, Ohio.
Territory: Ohio.
Specialization: 1, 5, 7. City shade tree maintenance programs.

E. D. Marshall, Consultant in Forest Products, 403 Court Ave., Ventura, California.
Territory: Western United States, Mexico, Central and South America.
Specialization: 3, 4, 11, 13, 16, 17, 19, 20, 21.

Raymond H. Marshall, Consulting Forester and Land Surveyor, 5 Pine Street, Littleton, New Hampshire.
Territory: Northern New Hampshire and Vermont.
Specialization: 3, 4, 6, 13, 15, 16, 17, 18.

Clyde S. Martin, Forest Consultant, 902 Puget Sound Bank Building, Tacoma 2, Washington.
Territory: Western United States and Canada.
Specialization: 2, 4, 6, 7, 8, 10, 15, 16, 17.

William Maughan, Consulting Forester, 5 Sylvan Road, Durham, North Carolina.
Territory: Southeastern United States.
Specialization: 2, 3, 4, 8, 16, 17, 18.

Edward A. McAllister, 311 Lynchburg Avenue, Colonial Heights, Virginia.
Territory: Virginia and Southeast.
Specialization: 3, 4, 9, 10, 11, 13, 16, 17.

The Ben Meadows Co., 315 Pharr Road, N. E., Atlanta, Georgia.
Consultant: *Ben C. Meadows.
Territory: Southeast.
Specialization: 4, 11, 13, 16, 17. Also complete line of forestry tools and equipment for the forester and timber owner.

***James W. Meteer,** Consulting Forester, R. D. 6, Wooster, Ohio.
Territory: Not limited.
Specialization: 2, 3, 4, 11, 16, 17, 18. Also Christmas tree management. Specialist in continuous forest inventory.

William H. Meyer, Consulting Forester, West Rupert, Vermont.
Territory: Northeast.
Specialization: 3, 4, 9, 11, 16, 17, 18. Also farm management and conservation education.

Richard V. Miles, III, Consulting Forester, 1006 First National Bank Bldg., Tuscaloosa, Alabama.

Specialization: 4, 8, 11, 13, 15, 16, 17, 18.

Raymond M. Miller, Consulting Forester, P. O. Box 802, Jamestown, New York.
Territory: Pennsylvania, New York.
Specialization: 4, 16, 17. Also timber and lumber marketing service.

Milliken Forestry Co., P. O. Box 5405, 500 Beltline Blvd., Columbia, South Carolina.
Consulting foresters: William F. Milliken, K. M. Allan, James R. Catheart.
Territory: Southeast, principally South Carolina.
Specialization: 3, 4, 6, 11, 13, 15, 16, 17, 18. Also tree planting; agent for absentee owners; hardwood-pine conversion work.

Walter L. Mills, Forester, 2308 Church Street, P. O. Box 21, Selma, Alabama.
Territory: Southeast.
Specialization: 2, 3, 4, 5, 6, 7, 10, 13, 16, 17, 18.

***William J. Mills**, Forest Engineer, 201 Volunteer Building, Chattanooga 2, Tennessee.
Territory: Southeastern states, Mexico.
Specialization: 3, 4, 11, 13, 15, 16, 17.

R. B. Milne, Consulting Forester, Box 371, Petersburg, Virginia.
Territory: Eastern states; all forest types.
Specialization: 3, 4, 10, 16, 17.

Stuart Moir, Forest Counsel, Diamond Head Road, Oswego, Oregon.
Territory: Western United States, British Columbia, Canada.

***Robert Moore**, Consulting Forester, Danville, Pennsylvania.
Territory: Not restricted.
Specialization: 2, 3, 4, 6, 8, 10, 11, 13, 15, 16, 17, 18, 19. Also bankruptcy cases, trade association work, land purchase and sales, timber buying, selling, and appraising. Licensed real estate broker, trusteeship cases, litigation and damage claims, and estate problems.

R. A. Morin, Consulting Forester, 2532 Sunset Ave., Greenville, North Carolina.
Territory: Eastern North Carolina.
Specialization: 4, 13, 16, 17, 18. Also growth studies, timber marking and marketing, and agent for absentee timberland owners.

George W. Morrill, Jr., Consulting Forester, R. F. D. #3, Concord, New Hampshire.
Territory: New Hampshire, Maine, Vermont.
Specialization: 4, 13, 15, 16, 18. Also landscaping, forest recreation, and beautification.

***Peter R. Mount**, Consulting Forester, Route #3, Kingston Springs, Tennessee.
Territory: Kentucky-Tennessee, Tennessee River Valley.
Specialization: 2, 3, 4, 8, 10, 11, 15, 16, 17, 18.

Charles H. Moyer, Consulting Forester, R. F. D. #2, Newfield, New York.
Territory: Northeast.
Specialization: 4, 10, 15, 16, 17.

National Timber Consultants, Box 497, Salem, Missouri.
Consultants: Ed Woods, Charles Kirk.
Territory: Central and southern states.
Specialization: Management information, land appraisal and valuation, mapping and estimating.

Chris Nelson, Jr., Consulting Forester, 132 West Crockett St., Jasper, Texas.
Territory: Southern and southwestern United States and tropical America.
Specialization: 3, 4, 16, 17, 18.

New England Forestry Foundation, 41 Mount Vernon Street, Boston 8, Massachusetts.
Consultants: *J. Milton Attridge, Stanley B. Coville, Frederic P. Elwert, Kenneth E. Jones, Allan W. Plumb, Donald R. Poppema, Fred A. Huntress, Jr., James Philip Rich.
Territory: New England.
Specialization: 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, 18.

New England Silvicultural Service, Athol Road, Petersham, Massachusetts.
Consultant: Fred M. Hunt.
Territory: Central New England.
Specialization: 4, 10, 15, 16, 17, 18. Also management of pine plantations.

S. A. Newman, Forest Engineers, P. O. Box 156, Everett, Washington.
Territory: Washington.
Specialization: 8, 10, 15, 16, 17.

***Leon A. Nix**, Consulting Forester and Logging Engineer, 260 N. Main St., Brampton, Ontario, Canada.
Territory: Not limited.
Specialization: 2, 3, 4, 6, 10, 13, 15, 16, 17. Also farm woodlot management.

Northeast Forestry Service, Inc., R. D. #1, Hawley, Pennsylvania.
Stanley Mesavage, Consulting forester.
Territory: New York, New Jersey, and Pennsylvania.
Specialization: 3, 4, 10, 11, 15, 16, 17.

Northern Timber Services, Curtis R. Lytle, Consulting Forester, Box 365, Wellsboro, Pennsylvania.
Territory: North central Pennsylvania.
Specialization: 4. Also sugar-bush and Christmas tree management.

Ernest Nutting, Consulting Forester, Box 51, Camden, South Carolina.
Territory: The Carolinas and Georgia.
Specialization: 4, 8, 13, 15, 16, 17, 18.

***Charles R. Page, Jr. and Associates**, Forest Land Managers and Consultants, 913 Harris Lane, Chattanooga 11, Tennessee.
Territory: Southeastern states.
Specialization: 3, 4, 5, 6, 7, 11, 15, 16, 17, 18.

Jim H. Panter, Consulting Forester, Hillcrest at Langham St., P. O. Box 469, Thomson, Georgia.
Territory: Georgia and adjoining states.
Specialization: 2, 4,9, 16, 17. Also timber cruising, selective marking, timber management and inventories including growth data. Agent for absentee landowners as consultant-manager. Preparation, negotiation, or advertisement and administration of timber sales for large and small timber landowners. Cutting supervision and boundary line establishment.

Benson H. Paul, Timber growth-quality, consultant, 1118 University Bay Dr., Madison 5, Wisconsin.
Territory: Not limited.
Specialization: 1, 3, 4, 11, 17, 21. Also silvicultural control of specific gravity for special products and uses; species quality comparisons and evaluations; preparation and presentation of reports for species promotion; lectures and seminars.

Pomeroy & McGowin, Forest Managers, Monticello, Arkansas, and Chapman, Alabama.
Consultants: L. K. Pomeroy, Julian F. McGowin (S.A.F. Associate Member), T. R. Scott, Jr., W. V. Gandy, D. W. Samson, D. L. Harper, H. C. Pennington, and A. C. Patton.
Territory: Southern states, South America.
Specialization: 4, 8, 11, 13, 16, 17, 18. Also aerial forest surveys.

Pond & Moyer, Inc., Co., Consulting Foresters, 107 Homestead Road, Ithaca, New York.
Consultant: *James D. Pond.
Territory, New York and Northeast, Latin America, northern hardwoods, spruce-fir, central hardwoods, tropical woods.
Specialization: 2, 3, 4, 8, 10, 11, 13, 15, 16, 17. Also damage and trespass appraisals.

Prentiss & Carlisle Company, Inc., Timberland Service — Engineers, 107 Court Street, Bangor, Maine.
Consultants: George T. Carlisle, Philip P. Clement, Robert W. Averill, George D. Carlisle, and William D. Barron.
Territory: United States, Canada.
Specialization: 2, 3, 4, 8, 10, 11, 13, 15, 16, 17, 18.

W. H. Price, Forest Consultant, 2626 West Lynn Street, Seattle 99, Washington.
Specialization: 1, 4, 6, 7, 8, 16, 17.

John G. Rawls Co., Consulting Foresters, 2793 Pinewood Drive, Macon, Georgia.
Consultant: John G. Rawls (S.A.F. Affiliate Member).
Territory: Southeast.
Specialization: 10, 12, 13, 15, 16, 17.

A. B. Recknagel, P. O. Box 15, Ithaca, New York.
Territory: Anywhere in United States and British Columbia.
Specialization: Forest management, forest utilization (particularly pulp and paper).

Tom Reimer, Forestry Consultant, P. O. Box 395, Albany, Georgia.
Specialization: 2, 8, 11, 13, 15, 18.

Owen L. Riley and Assoc., Forest Managers and Consultants, P. O. Box 31, Pine Mt. Valley, Georgia.
Consultants: *Owen L. Riley, Hugh P. Riley.
Territory: Georgia and Alabama.
Specialization: 4, 6, 7, 9, 11, 16, 17, 18. Also agent for timberland owners: timber marketing and assistance; damage appraisal.

F. Herbert Robertson, Consulting Forester, 1026 W. Eighth Street, Panama City, Florida. Phone: POplar 3-5049.
Territory: Alabama, Georgia, Florida.
Specialization: 4, 5, 6, 7, 16. Also reforestation, brokerage in standing timber. Purchase and sale of timbered properties. Agent for absentee forest land owners. Forest tree seed sales.

James A. Rogers, Consulting Forester, P. O. Box 3, San Pedro Sula, Honduras, C. A.
Territory: Central America and southern states.
Specialization: 2, 3, 4, 6, 10, 11, 13, 16, 17, 18.

A. P. Russell, Consulting Forester, 11 Maplewood Drive, Sumter, South Carolina.
Territory: Unlimited, principally southern region.
Specialization: 2, 3, 4, 10, 11, 13, 15, 16, 17, 18. Also forest resource surveys for industry, specializing in southern hardwoods.

Sable Mountain Corporation, 68 Phillips Street, Rutland, Vermont.
Consultants: *Richard C. Rose, Benjamin F. Hoffman, Jr.
Territory: Central Vermont.
Specialization: 4, 15, 16, 17, 18. Also complete woodland management, including marking and marketing of standing timber and trained work crew for planting, pruning, and timber stand improvement. Also operate own forest.

Eino Sainio, Consulting Forester, 320 W. Helen St., Newberry, Michigan.
Territory: Eastern Upper Peninsula of Michigan.
Specialization: 3, 4, 13, 15, 16, 17. Registered land surveyor and registered forester.

***Valentin Sajor**, 101 Kanlaon Street, Quezon City, Philippines.
Territory; Nationwide; Philippines.
Specialization: 1, 4, 14, 15, 16, 18. Also grazing, landscaping, and tree farming.

***Paul M. Sanders**, Consulting Forester. 916 Yeon Bldg., Portland 4, Oregon.
Territory: Unrestricted.
Specialization: 2, 4, 6, 8, 15, 16, 17, 18. Property management for absentee owners.

Roy Dale Sanders, Visual Education Technician, Rural Route 6, Evrodale, Brainerd, Minnesota.
Territory: Unlimited.
Specialization: Forester, wildlife technician, photographer. The entire production supervision of 16 millimeter color educational motion pictures, including script writing, direction, photography, editing, and sound supervision. Also production of color and black and white still picture visual education material.

Sandhill Forestry Company, 206 Surginor Road, Rockingham, North Carolina.
Consultant: *Walter J. Marshburn, Jr.
Territory: Southeastern United States.
Specialization: 3, 4, 6, 13, 16, 17, 18. Also woodland property sales.

***L. E. Sawyer**, R. R. #1, West Terre Haute, Indiana.
Territory: Indiana, Illinois, western Kentucky.
Specialization: 4, 5, 6, 7, 16, 17, 18.

Joseph A. Schmidt, Consulting Forester, Box 470, Charleston, South Carolina.
Territory: Southeast.
Specialization: 4, 13, 15, 16, 17. Also growth studies, timber marking.

William R. Schofield, Forest Engineer & licensed Civil Engineer, 681 Market Street, San Francisco 5, California.
Territory: California.
Specialization: 5, 6, 7, 8, 15, 16, 18.

C. D. Schultz & Co., Inc., Forestry and Engineering Consultants, 545 White-Henry-Stuart Building, Seattle, Washington.
Consultant: C. D. Schultz.
Territory: Arizona, Oregon, Washington, California mainly; but no regional limitations.
Specialization: 2, 3, 4, 6, 8, 10, 11, 15, 16, 17, 18, 20.

C. D. Schultz & Co., Ltd., Forestry and Engineering Consultants, 325 Howe Street, Vancouver, British Columbia.
Consultants: C. D. Schultz and 46 members of the Canadian Institute of Forestry. Present staff 12 members.
Territory: No regional limitations.
Specialization: 2, 3, 4, 6, 8, 10, 11, 13, 15, 16, 17, 18, 19, 20.

Thomas F. Schweigert, Consulting Forester, Penney Building, Petoskey, Michigan.
Territory: Michigan.
Specialization: 4, 8, 15, 16, 17, 18. Registered forester, registered land surveyor.

James W. Sewall Company, Consulting Foresters, Old Town, Maine, and Fredericton, New Brunswick, Canada.
Consultants: Frank M. Call, Charles Slight, Carleton C. Young, Jr., Theodore C. Tryon, Earl W. Raymond, Edwin Forsythe.
Territory: Northeast.
Specialization: 3, 4, 5, 8, 13, 15, 16, 17, 18. Also aerial photography.

R. B. Shannon & Associates, Professional Engineers, Registered Surveyors, Consulting Foresters, Box 23, Kittanning, Pennsylvania; also Indiana, Pennsylvania.
Consultants: *Robert B. Shannon, Maurice E. Hobaugh.
Territory: Pennsylvania, New York, Ohio, West Virginia.
Specialization: 2, 4, 15, 16, 17, 18. Also timber damage appraisals; photogrammetric cartography. civil engineering.

B. C. Sherrill, Consulting Forester, 515 Coyote St., Nevada City, California. Associated with J. F. Siegfried. Agricultural engineer, mining engineer, and licensed land surveyor.
Territory: California; pine, redwood and fir.
Specialization: 4, 10, 15, 16, 17, 18. Also aerial photo interpretation, licensed land surveys, and Christmas tree management.

William R. Sizemore & Co., Foresters, Surveyors, and Land Managers, Tallassee, Alabama.
Consultants: William R. Sizemore, and Mary H. Sizemore (S.A.F. Associate Member).
Territory: Southeast.
Specialization: 2, 3, 4, 8, 11, 13, 15, 16, 17, 18.

Samuel S. Snook, P. O. Box 521, Walterboro, South Carolina.
Territory: South Carolina.
Specialization: 4, 15, 16, 17.

James B. Snowden, Consulting Forester, Route #3, Quincy, Florida. Phone: MAin 7-6093.
Territory: Florida, Georgia, and southeast Alabama.
Specialization: 4, 5, 6, 7, 12, 16, and 17.

Dean Solinsky, Hobart Bldg., San Francisco 4, California.
Territory: California.
Specialization: Timberland appraisals and management.

***Seymour I. Somberg**, 100 Rogers Court, Birchwood Park, Williamsburg, Va. Phone CApital 9-5348.
Territory: Southeastern U. S. and Latin, Central, and South America.
Specialization: 2, 3, 4, 8, 10, 11, 13, 15, 16, 17, 20. Acquisition and management for investors; forest resource surveys for industry.

South Carolina Forest Management Service, Ritter, South Carolina.
Forest Consultant: Hugo J. Pawek.
Territory: West Virginia, Virginia, North Carolina, South Carolina, Tennessee, Georgia, Florida, and Alabama.
Specialization: 3, 4, 5, 6, 7, 16, 17.

Southern Timber Management Service, Home Office, P. O. Box 7527, Birmingham 13, Alabama. Branch Offices, 404 Montgomery Avenue, Sheffield, Alabama; 138 W. Magnolia Avenue, Auburn, Alabama; P. O. Box 564, Brookhaven, Mississippi, and 703 James Blvd., Signal Mountain, Tennessee.
Consultants: *J. M. Bradley, W. H. Mullins, H. E. Murphy, C. B. Umland, Tom Newman, John Keesey, Kenneth Hotopp, Guy Parsons, and John White.
Territory: South, Central Atlantic, and South America.
Specialization: 1, 2, 3, 4, 8, 10, 11, 12, 13, 15, 16, 17, 18, 21. Also acting as timberland investment counsel and land agent and forester in charge for private, commercial, and absentee-owned timberlands of all sizes with optional complete timber stand improvement cutting, milling, and T.S.I. operations as a service under contract. Contracted objectives under long-range manage-

ment contract offered. Resource surveys and industrial plant location services. Forest tree seed, wholesale and retail. Direct seeding and chemical hardwood spray control.

Frank Spearey, Consulting Forester, Registered Public Surveyor, P. O. Box 1249, Jacksonville, Texas.
Territory: Gulf States.
Specialization: 4, 15, 16, 17. All phases of land management.

Wallace R. Stacy, Consulting Forester, P. O. Box 21, Walterboro, South Carolina.
Territory: Within 100 miles of Walterboro.
Specialization: 3, 4, 6, 7, 13, 16, 17, 18. Also growth studies, timber marking, fire damage appraisals, forest mapping, timber trespass appraisals, pulpwood and timber sales, timberland agent for absentee timberland owners.

T. J. Starker and Son, 3855 Van Buren Street, Corvallis, Oregon.
Operating consultants: T. J. Starker, Bruce Starker.
Territory: Oregon.
Specialization: 1, 3, 4, 10, 16, 19, 21.

***J. F. Stauss,** Consulting Forester, 9 Nowlan Road, Hillcrest, Binghamton, New York.
Territory: Northeast and Canada.
Specialization: 2, 3, 4, 8, 10, 11, 13, 15, 16, 17, 18. Also marketing and other forest products; litigation and damage claims.

Charles T. Stealey, Jr., Consulting Forester, 1505 N. Roberson, Conroe, Texas.
Territory: Texas and surrounding states.
Specialization: 4, 6, 7, 13, 16, 17, 18.

***Edward F. Steigerwaldt,** Consultant Forester, Star Route 2, Tomahawk, Wisconsin.
Territory: Lake States.
Specialization: 4, 8, 11, 13, 15, 16, 17, 18. Also aerial photography plans, forest surveys, forest photography, photo interpretation, and property management for absentee land owners.

Fred Stell, Consulting Forester, P. O. Box 42, Glenwood Springs, Colorado.
Territory: Colorado, Wyoming, New Mexico.
Specialization: 4, 6, 9, 14, 15, 16, 17, 18.

Stevens Forestry Service, Consulting Foresters, Box 1070, El Dorado, Arkansas.
Consultants: *Irwin E. Stevens, Jim W. Bottoms.
Territory: Southern states.
Specialization: 1, 3, 4, 11, 13, 15, 16, 17, 18.

Raymond E. Stevens, Consulting Forester, 4416 McCulloch Street, Duluth 4, Minnesota.
Territory: Northern parts of Minnesota, Wisconsin.
Specialization: 4, 15, 16, 17, 18. Also field investigation and forest litigation.

John W. Stock, Consulting Forester and Licensed Land Surveyor, Tupper Lake, New York.
Territory: Adirondack Mountains.
Specialization: 3, 4, 10, 15, 16.

William S. Stover, 6178 Louisville Street, New Orleans 24, Louisiana.
Territory: Not limited.
Specialization: Forest resource and related investigations; design and planning of forest inventories, and other studies.

W. W. Talbert, Forest Consultant, 1112 Pershing St., Lufkin, Texas.
Territory: Texas and surrounding states.
Specialization: 4, 6, 16, 17, 18.

Tex-La Land Management Service, P. O. Box 38, Jasper, Texas.
Consultant: *A. C. Bace, Jr.
Territory East Texas and western Louisiana.
Specialization: 3, 4, 5, 6, 7, 11, 13, 16, 17, 18. Also acting as land and forest managers for private, commercial, and absentee-owned timberlands as a service under contract.

Harley H. Thomas, Jr., Forest Consultant, 101 Green Street, Doniphan, Missouri.
Territory: Arkansas, Illinois, Missouri.
Specialization: 4, 6, 9, 15, 16, 17. Also agent for absentee owners.

Thaddeus Thorne, Consulting Forester, Center Conway, New Hampshire.
Territory: Northeast.
Specialization: 2, 4, 15, 16, 17, 18. Timber sales, marking, forestland real estate.

Tillinghast & Reed, Consulting Foresters, Danville, West Virginia, Phone: Madison, West Virginia, 771.
Consultants: *John Tillinghast, *Marvin Reed, O. O. Neely, Jr.
Territory: West Virginia, eastern Kentucky, western Virginia.
Specialization: 3, 4, 6, 15, 17, 18, 19, 20. Timberlands in coal-producing areas a specialty; services available on job basis or on annual retainer fee. Also dealers and distributors forestry equipment.

Timber Management Service, P. O. Box 953, Klamath Falls, Oregon.
Consultant: *Robert W. Mezger.
Territory: Ponderosa pine region.
Specialization: 2, 3, 4, 6, 8, 15, 16, 17, 18.

J. M. Tinker, Forester and Realtor, 30 Seibald Street, Statesboro, Georgia.
Territory: Savannah trade area.
Specialization: Timber estimates and sales, timberland appraisals and sales, management plans.

Anton J. Tomasek, 1828 Lincoln, Des Plaines, Illinois.
Territory: Illinois, Indiana, Michigan, and Wisconsin.
Specialization: 3, 4, 9, 11, 16, 18. Also tree diseases and insects, forest recreational development.

Tree Farm Management Service, Inc., 1166 7th Avenue West, Eugene, Oregon.
Consultants: *Verne D. Bronson, chief forester; Douglas B. Watson, John W. Davis, H. N. Cory.
Territory: Not limited.
Specialization: 2, 3, 4, 5, 6, 7, 8, 9, 13, 15, 16, 17, 18. Complete tree farm management, inventory and special studies of forest lands, salvage harvest supervision, forestry research, aerial photo procurement and interpretation.

Henry H. Tryon, Consulting Forester, retired, 327 Mountain Road, Cornwall-on-Hudson, New York.
Specialization: Sprout hardwoods.

J. N. Van Alstine, Consulting Forester, Stark Road, Center Conway, New Hampshire.
Territory: Appalachians, Blue Ridge, Northeast.
Specialization: 4, 15, 17. Also land capability classification for timber, hydrology, wildlife, fish, minerals, timber quality, and check estimates.

Van Vliet and McKimmy, Forest Products Specialists, 2425 Hayes Street, Corvallis, Oregon.
Consultants: A. C. Van Vliet and M. D. McKimmy.
Territory: Oregon, Washington, and California.
Specialization: 3, 11, 19, 20, 21. Also industrial engineering applications, feasibility studies, production and quality control techniques, and analysis of specific problems related to wood properties in the production of forest products.

James M. Vardaman & Company, First National Bank Bldg., Laurel, Mississippi.
Consultants: James M. Vardaman and John D. Guy, Jr.
Territory: Southeastern United States.
Specialization: 16, 17. Also own and operate medium-sized tree farm.

Myron Wall & Associates, Foresters and General Appraisers, P. O. Box 269, Tahoe City, California.
Consultants: Myron Wall and James F. Nicklos, 4340 Morpheous Lane, Sacramento 25, California.
Territory: California, Nevada, Idaho, Arizona, New Mexico, Colorado, southern Oregon, Montana, and the Dakotas.
Specialization: 2, 3, 4, 5, 6, 7, 8, 10, 15, 16, 17, 18, 19, 20, 21. Also are associated with Marshall & Stevens, valuation engineers in the practice of general appraising, i.e. commercial, residential, rural, industrial, etc., for market value, taxation, purchase & sale, insurance, condemnation, refinancing and economic purposes. In addition we handle land and timber sales, provide logging supervision and scaling services.

George E. Warren, P. O. Box 335, Sylvester, Georgia.
Specialization: 4, 6, 12, 13, 15, (registered land surveyor) 16, and 17.

Robert D. Washburn, Forestry Consultant, Route 1, Box 461, Marquette, Michigan.
Territory: Upper Michigan and the Lake states.
Specialization: 2, 4, 10, 15, 16, 17. Also land appraisal. Registered surveyor, registered forester, State of Michigan, and real estate broker-appraiser.

Arthur J. Weinheimer, Consulting Forester, R.F.D. # 1, Old Chatham, New York.
Territory: Eastern New York.
Specialization: 4, 18.

Western Timber Services, Arcata Hotel, Arcata, California.
Consultant: Robert E. Kleiner.
Territory: Not restricted.
Specialization: 2, 4, 8, 10, 15, 16, 17, 18.

***J Atwood Whitman,** Consulting Forester, Glendon, North Carolina.
Territory: Eastern and southern United States.
Specialization: 2, 3, 4, 8, 15, 16, 17, 18. Also forest damage appraisal, forest litigation, growth analysis, timber type maps and municipal forestry.

S. A. Wilde, Soils Department, University of Wisconsin, Madison 6, Wisconsin.
Territory: Wisconsin, Minnesota, Michigan, Missouri, Illinois, Indiana, Ohio.
Specialization: 18. Including survey of forest tracts, selection of planting sites, management of forest nursery soils, particularly restoration of fertility in depleted and biocide-treated nursery soils.

Gerald H. Williams, Consulting Forester, 12 Hersh Avenue, Westminster, Maryland.
Territory: Middle Atlantic and Southeastern States.
Specialization: 3, 4, 13, 16, 17.

John F. Williams & Co., Foresters, Windsor, North Carolina.
Territory: Southeastern U. S.
Specialization: 2, 3, 4, 13, 15, 16, 17 with emphasis on forest management and tree planting.

Richard E. Wilson, 11½ Fifth Ave., Saratoga Springs, New York.
Territory: Not restricted.
Specialization: 18. Establishment and care of plantations.

S. Leigh Wilson, Consulting Forester, 605 Camellia Circle, Florence, South Carolina.
Consultants: S. Leigh Wilson, and Don M. Handley.
Specialization: 3, 4, 16, 17, 18.

Fred E. Winch, Jr., Consulting Forester, Sebring Road, R. 2, Newfield, New York.
Territory: Northeast.
Specialization: 4, 11, 18. Primarily associated with maple sirup and Christmas tree production.

Paul T. Winslow, Consulting Forester, Staatsburg, Duchess County, New York.
Territory: Northeast.
Specialization: 1, 3, 4, 11, 15, 16, 17, 18.

E. T. F. Wohlenberg, Consulting Forester, P. O. Box 246, Ukiah, California.
Associated with Emanuel Fritz, Consultant, 102 The Uplands, Berkeley 5, California.
Territory: (The West); pine, redwood, and fir.
Specialization: 2, 3, 4, 6, 7, 8, 10, 11, 13, 16, 17, 18.

K. B. Wood and Associates, Inc., 601 Dekum Bldg., Portland 4, Oregon.
Territory: National.
Specialization: 2, 10, 15, 16, and 17.

J. E. Woodman, Barnett Bank Building, Jacksonville 2, Florida.
Territory: Eastern United States and Canada.
Specialization: 2, 4, 8, 12, 13, 16.

Herman Work, 200 N. Market St., Staunton, Virginia.
Territory: General.
Specialization: 2, 3, 4, 6, 11, 13, 16.

E. A. Ziegler, Consulting Forester, College Park, Lewisburg, Pennsylvania.
Territory: Middle Atlantic states and Southeastern states to and including Florida.
Specialization: 2, 3, 4, 6, 8, 12, 13, 15, 16, 17, 18.

CONSULTING FORESTERS, CLASSIFIED BY STATES

Alabama
Glenn O. Antonie
Richard V. Miles, III
Walter L. Mills
William R. Sizemore & Co.
Southern Timber Management Service

Arkansas
Pomeroy & McGowin
Stevens Forestry Service

California
Airview Specialists Corp.
James E. Asher
Russell W. Beeson
Charles H. Bunting
Cal-Pacific
Emanuel Fritz
George I. Gentry
L. Neil Gilliam
Hammon, Jensen, and Wallen
Gion B. Hooker
Arthur Koehler
Jack E. Larson
Robert T. MacDougall, Jr.
E. D. Marshall
William R. Schofield
B. C. Sherrill
Dean Solinsky
Myron Wall & Assoc.
Western Timber Services
E. T. F. Wohlenberg

Colorado
Fred Stell

Connecticut
Connwood, Inc.
George C. Kiefer, Jr.
Donald K. Maissurow

District of Columbia
Albert G. Hall & Associates

Florida
John T. Clark
Francis H. Clifton
Deep South Consulting Foresters
E. A. Foster
Charles G. Geltz Assoc.
Gene M. Harris
Douglas F. Horan
T. M. Howerton, Jr.
John E. Hudson
F. Herbert Robertson
James B. Snowden
J. E. Woodman

Georgia
W. R. Barnhill
Edward J. Clancy
Forest Services, Inc.
Giles G. Hall
Jack M. Hall
Arthur W. Hartman
E. T. Hawes
Ed Knapp Co.
The Langdale Company
T. A. Liefeld
The Ben Meadows Co.
Jim H. Panter
John G. Rawls
Tom Reimer
Owen L. Riley & Assoc.
George E. Warren

Idaho
Intermountain Timber Service

Illinois
Anton J. Tomasek

Indiana
Carl M. Carpenter
Foresters, Inc.
L. E. Sawyer

Kentucky
Dudley C. Carey
John M. Crowl

Louisiana
Henry L. Bango
Frank W. Bennett & Associates
Robert H. Cain
Farmcraft Associates, Inc.
W. H. Griffith
Ralph W. Hayes
John F. Kellogg
Frank J. Lemieux
William S. Stover

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Prentiss & Carlisle Company, Inc.
James W. Sewall Company

Maryland
John F. Davis
Ivan M. Elchibegoff
L. J. Enright
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Massachusetts
New England Forestry Foundation
New England Silvicultural Service

Michigan
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Forestry Consulting Services, Inc.
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Thomas F. Schweigert
Robert D. Washburn

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Roy Dale Sanders
Raymond E. Stevens

Mississippi
Keith Cranston
Randle J. Dedeaux
Employment Service
Forestry Suppliers, Inc.
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D. E. Lauderburn
James M. Vardaman & Co.

Missouri
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Thaddeus Thorne
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Felsa Co.

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R. C. Fraunberger
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Tex-La Land Mgmt. Service

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SOCIETY OF AMERICAN FORESTERS
Washington 6, D. C.

Foresters' Code of Ethics

Adopted November 12, 1948

The purpose of these canons is to formulate guiding principles of professional conduct for a forester in his relations with other foresters, with his employers, and with the public. The observance of these canons secures decent and honorable professional and human relationships, establishes enduring mutual confidence and respect, and enables the profession to give it maximum service.

Professional Life

1. The professional forester will utilize his knowledge and skill for the benefit of society. He will cooperate in extending the effectiveness of the forestry profession by interchanging information and experience with other foresters, and by contributing to the work of forestry societies, associations, schools, and publications.

2. He will advertise only in a dignified manner, setting forth in truthful and factual statements the services he is prepared to render for his prospective clients and for the public.

Relations With the Public

3. He will strive for correct and increasing knowledge of forestry and the dissemination of this knowledge, and will discourage and condemn the spreading of untrue, unfair, and exaggerated statements concerning forestry.

4. He will not issue statements, criticism, or arguments on matters connected with public forestry policies, without indicating, at the same time, on whose behalf he is acting.

5. When serving as an expert witness on forestry matters, in a public or private fact finding proceeding, he will base his testimony on adequate knowledge of the subject matter, and render his opinion on his own honest convictions.

6. He will refrain from expressing publicly an opinion on a technical subject unless he is informed as to the facts relating thereto, and will not distort or withhold data of a substantial or other nature for the purpose of substantiating a point of view.

Relations With Clients, Principals, and Employers

7. He will be loyal to his client or to the organization in which he is employed and will faithfully perform his work and assignments.

8. He will present clearly the consequences to be expected from deviations proposed if his professional forestry judgment is overruled by nontechnical authority in cases where he is responsible for the technical adequacy of forestry or related work.

9. He will not voluntarily disclose information concerning the business affairs of his employers, principals, or clients, which they desire to keep confidential, unless express permission is first obtained.

10. He will not, without the full knowledge and consent of his client or employer, have an interest in any business which may influence his judgment in regard to the work for which he is engaged.

11. He will not, for the same service, accept compensation of any kind, other than from his client, principal, or employer, without full disclosure, knowledge, and consent of all parties concerned.

12. He will engage, or advise his client or employer to engage, other experts and specialists in forestry and related fields whenever the client's or employer's interests would be best served by such actions, and will cooperate freely with them in their work.

Relations With Professional Foresters

13. He will at all times strive to protect the forestry profession collectively and individually from misrepresentation and misunderstanding.

14. He will aid in safeguarding the profession against the admission to its ranks, of persons unqualified because of lack of good moral character or of adequate training.

15. In writing or in speech he will be scrupulous to give full credit to others, in so far as his knowledge goes, for procedures and methods devised or discovered and ideas advanced or aid given.

16. He will not intentionally and without just cause, directly or indirectly, injure the reputation or business of another forester.

17. If he has substantial and convincing evidence of unprofessional conduct of a forester, he will present the information to the proper authority for action.

18. He will not compete with another forester on the basis of charges for work by underbidding through reduction of his quoted fee after being informed of the fee quoted by a competitor.

19. He will not use the advantages of a salaried position to compete unfairly with another forester.

20. He will not attempt to supplant another forester in a particular employment, after becoming aware that the latter has been definitely engaged.

21. He will not review the work of another forester, for the latter's employer, without the other's knowledge, unless the latter's connection with the work has been terminated.

22. He will base all letters of reference or oral recommendation on a fair and unbiased evaluation of the party concerned.

23. To the best of his ability he will support, work for, and adhere to the principles of the merit system of employment.

24. He will not participate in soliciting or collecting financial contributions from subordinates or employees for political purposes.

25. He will uphold the principle of appropriate and adequate compensation for those engaged in forestry work, including those in subordinate positions, as being in the public interest and maintaining the standards of the profession.

REPRINTS AVAILABLE

Reprints of this Consulting Foresters Directory are available from the Society of American Foresters, Mills Building, Washington 6, D. C., at the following rates, plus mailing charges.

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